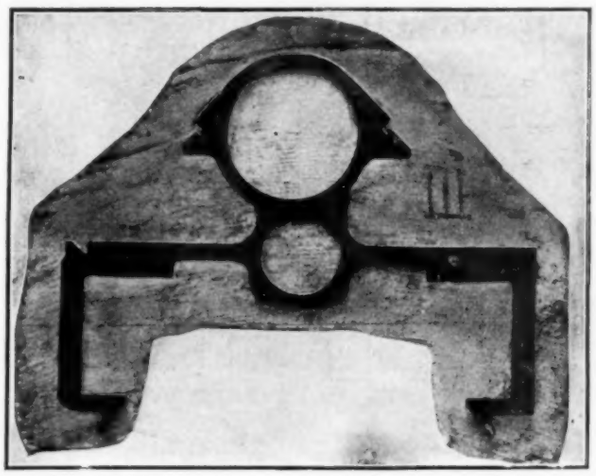
March 18, 1920 American Machinist Vol. 52, No. 12



Unusual Methods of Securing Extreme Accuracy—I

By A. L. De LEEUW, M. E.
Consulting Engineer

Accurate drilling and boring of long holes is one of the greatest of shop problems. When two holes must be bored parallel, the problem increases in difficulty. This article tells how the preliminary machine work necessary to the locating and boring of such holes was performed. The illustrations show the problems clearly.

THE problem of making an accurate recoil mechanism for gun carriages is a particularly difficult one, both on account of the extreme accuracy required in the component parts as well as owing to the very large amount of metal to be removed from the main, or cradle, forging. This main forging was supposed to weigh 950 lb. in the rough and 215 lb. after machining; but, due to the lack of satisfactory heavy forging machinery, it weighed from 1,300 to 1,350 lb. and it did not seem possible to reduce this weight and still make a forging which could be completely turned up. Fig. 1 and some of the other views show the irregularities in the forging. The waves or irregularities were sometimes as much as 1¼ in. in depth.

The unfinished appearance of the trunnion lugs, and the curved outlines of the forgings can readily be seen. Fig. 2 shows the large amount of metal allowed, but it sometimes happens that even with this it was barely possible to true up the trunnion. Fig. 3 shows the cross-section of the forging to which has been fastened a steel templet showing the cross-section of the finished part; the two holes shown are the result of the first operation.

Fear was expressed that, due to the removal of such a large amount of metal and to the delicate shape of the product, there would be great danger of twisting and warping of the forging after machining. It was found, however, that with the sequence of operations adopted, there was no trouble from this source. As a matter of precaution it was decided to leave a small amount of metal on the inside of the slide part to be removed after finish-boring; and, though this was regularly done, it was more than doubtful whether this operation was really necessary.

A Laying-Out Machine

As the forgings came so rough and of such uncertain dimensions, it was necessary to lay out every forging very carefully before machining. This at first required the services of a skilled man and consumed a great deal of time. As the plant was originally laid out for a capacity of 25 finished recoil mechanisms, and required 30 of these finished forgings per day to allow for waste, a machine was designed to do this laying out quickly, accurately and with unskilled help.

This machine is shown complete in Fig. 4 with details in Figs. 5 and 6. It consists of a bed, and means of shifting the forging as desired and for finally clamping it in the proper position. To obtain this position, brackets were used which could slide in grooves in the bed, these brackets carrying feeler rods which could be placed by hand, in vertical or horizontal directions, against the forging. If these rods touched the forging in any position of the brackets on the bed, then the

FIG. 1. THE IRREGULARITIES OF THE FORGINGS

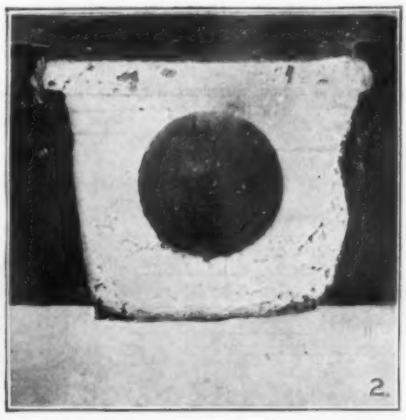


FIG. 2. SURPLUS METAL ON TRUNNION

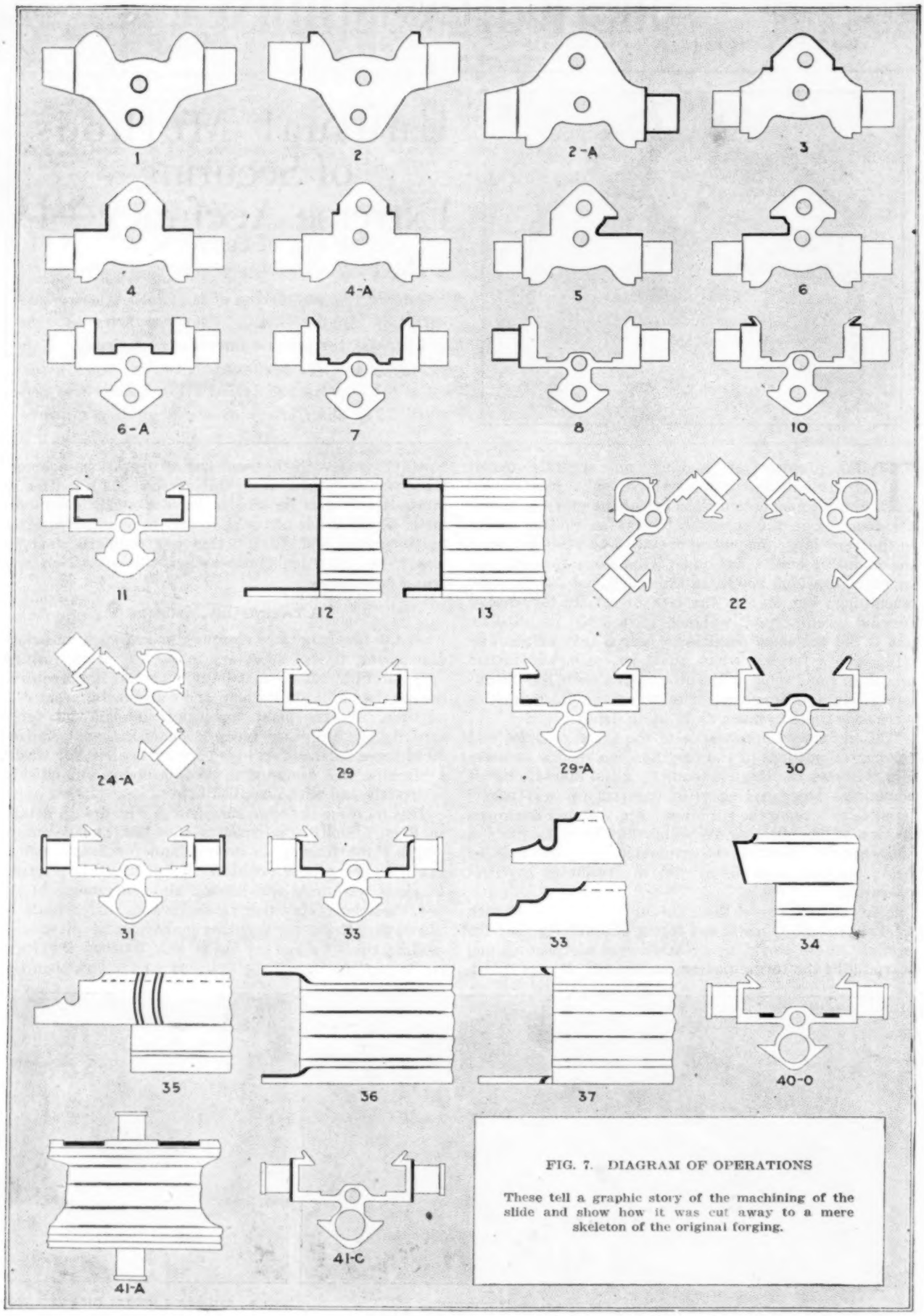


FIG. 7. DIAGRAM OF OPERATIONS

These tell a graphic story of the machining of the slide and show how it was cut away to a mere skeleton of the original forging.

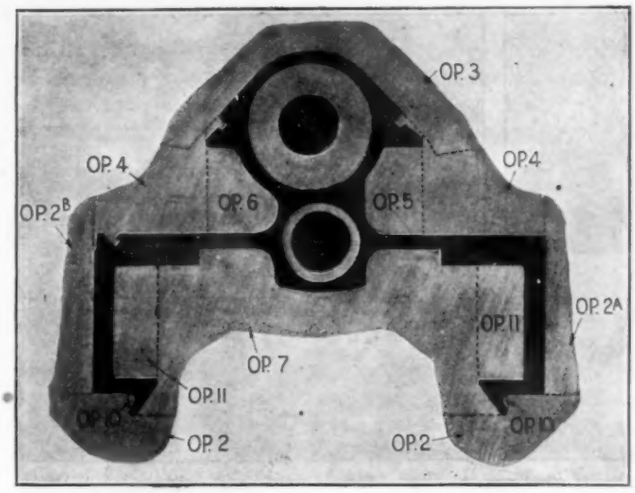


FIG. 3. METAL REMOVED AT VARIOUS OPERATIONS

forging would have sufficient metal for finishing at all points. If one of the feeler rods, when placed over or along the forging, failed to touch it, then the forging was shifted horizontally or vertically, or turned around its axis, until the rod struck.

At each end of the bed a drill head was mounted, the head containing two drill spindles, each having an independent belt drive. The feed was by hand. The holes drilled in this position corresponded with the center of the holes which finally would have to be bored through the forging and were small enough so that it was not necessary to drill them with extreme accuracy. These holes were the starting point of all the subsequent operations. Fig. 5 shows the construction of the feeler rods and brackets. The method of locating the center for the trunnion parts by means of center punch is shown also. Fig. 6 shows the drill heads and jig brackets.

THE LOCATING SURFACES

The sequence of operations is shown in Fig. 7. The milling of the two guide strips at the bottom of the forging, operation 2, is shown in Fig. 8, where the piece is set up for operation. This operation was performed on a 24-in. milling machine with an inclined rail. The illustration clearly shows the jig and holding devices, and especially shows how the holes drilled in operation 1 were used for locating the forging for this operation. The cutting speed for this operation was 57 ft. per minute, the feed 0.78 in. and the time for finishing a piece about 2 hr. Before the milling machines were completely installed, this process was done in a planing machine, requiring about 8 hr. per piece.

After this operation the lips thus milled and the surfaces thus obtained were used as gages or control points for further operations.

Fig. 9 shows operation 2A—rough-milling the sides and the stock around the end of one trunnion. This operation was not contemplated in the original layout but the additional amount of metal of the forging made it necessary to remove some of the metal before the finishing of the sides. The method of holding the piece is clearly shown, including the hardened-steel plates against which the lips of the forging are located before milling. This operation was done on a No. 5 milling machine and required two settings, as the trunnion lug, which is practically in the center of the forging, would not allow of completing one side in a single setting. The milling machines were consequently arranged in pairs, one running right hand and the other left hand, so that one pair of milling machines could take care of a complete side. The depth of cuts varied widely with the forgings, being sometimes as much as $1\frac{7}{16}$ in. The feed was $1\frac{1}{4}$ in. per minute. The style of cutter used was the $8\frac{1}{4}$-in. high-power face-mill with an extra amount of projection of the blades beyond the body. Operation 2B is the same as the previous one but on the other side of the forging.

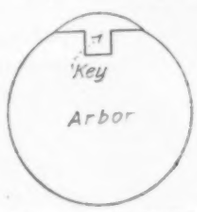


FIG. 11. KEY USED IN MILLING CUTTERS

Operation 3 is shown in Fig. 10 and consists of shaping the top of the forgings. This was done on a 24-in. horizontal machine with inclined rail and interlocking cutters. The cutters were kept as small as possible but were nevertheless 8 in. in diameter. This was caused by the fact that the arbor was 3 in. in diameter and further, that a deep section of metal had to be cut. In these cutters and in all gangs of cutters for heavy work, a cylindrical key, as shown in Fig. 11, was used. With this key no trouble was experienced in getting the cutters on or off the arbor.

WHERE A LIGHT CUT BREAKS CUTTERS

Fig. 12 shows operation 4 which was done on a double-spindle 24-in. machine with vertical heads, using a cutter which was 5 in. in diameter and 4 in. high. The

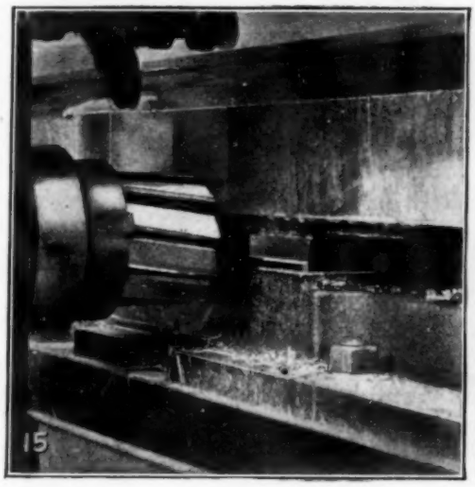


FIG. 15. FINISHING THE SIDES

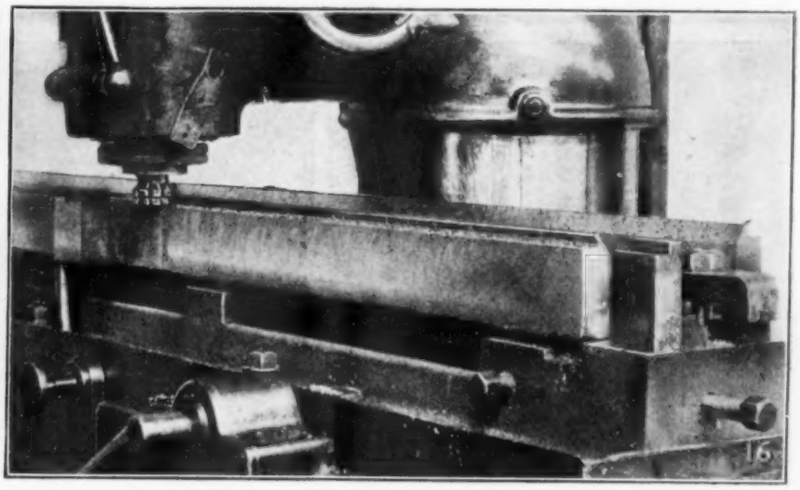
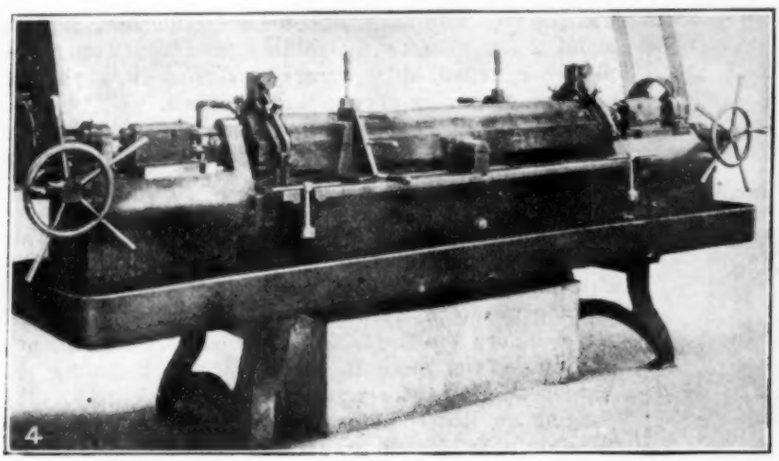
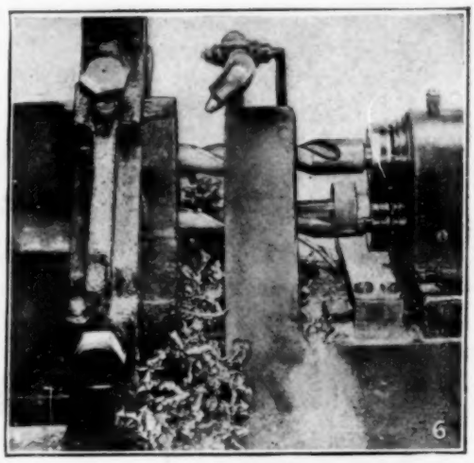
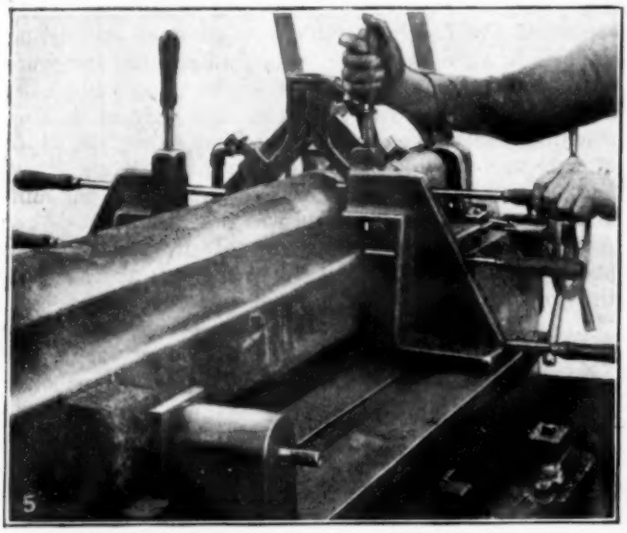
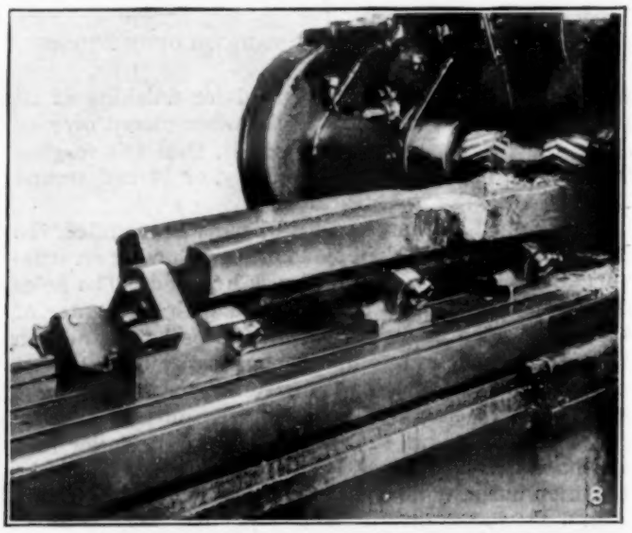


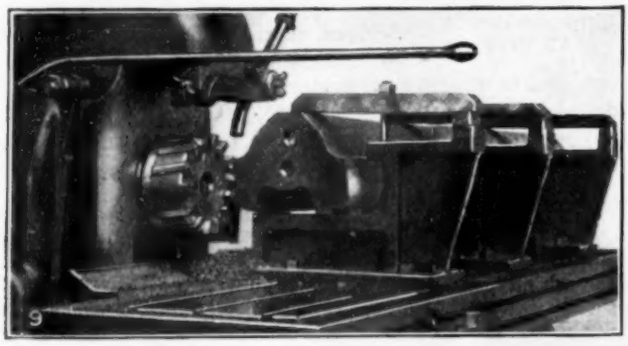
FIG. 16. UNDERCUTTING THE LIP

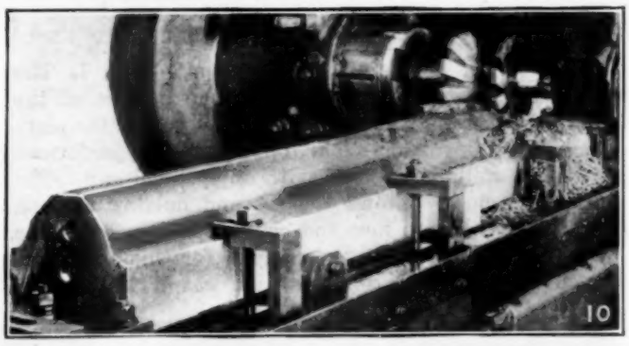


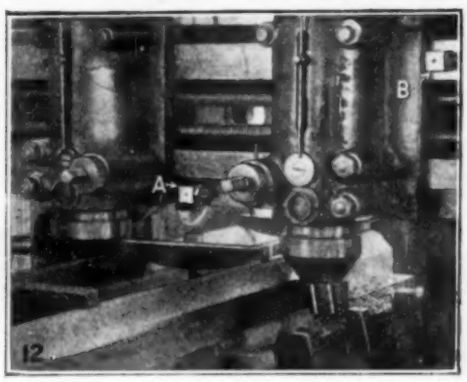


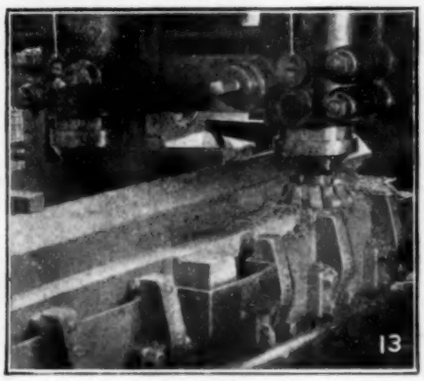


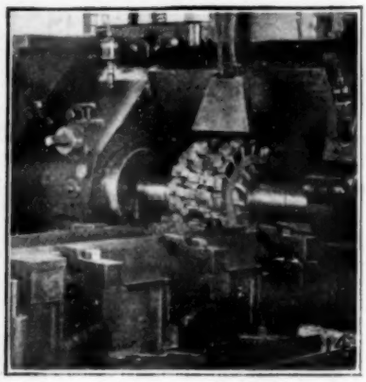












FIGS. 4, 5, 6, 8, 9, 10, 12, 13 AND 14. NINE INTERESTING OPERATIONS ON ROUND SLIDE

Fig. 4—Machine for laying out forgings. Fig. 5—How the machine is used. Fig. 6—Drilling the two pilot holes. Fig. 8—Milling the locating surfaces. Fig. 9—Removing material from side. Fig. 10—Milling the back of forgings. Fig. 12—A heavy milling cut. Fig. 13—Undercutting the sides. Fig. 14—Milling out the channel.

illustration will show how extremely heavy this cut was. It also shows the peculiar style of stub arbor used, as it could not be expected that any ordinary kind of arbor would stand up under this heavy duty.

By a misunderstanding of the instructions, the men in the shop divided this operation into two cuts, and invariably broke the cutter or arbor, or both, on the second cut. When, however, the entire amount of metal was removed in one cut there were no breakages. This was due to the fact that the metal to be removed lying immediately back of the body of the cutter prevented the cutter from pulling itself into the cut. It will be noticed that stops were provided on the cross-rail to keep the heads from moving under the cut. Two of these are shown at *A* and *B*. The illustration shows clearly how the pieces were clamped and how two pieces were done at one setting. It also shows the steel water guard around the table.

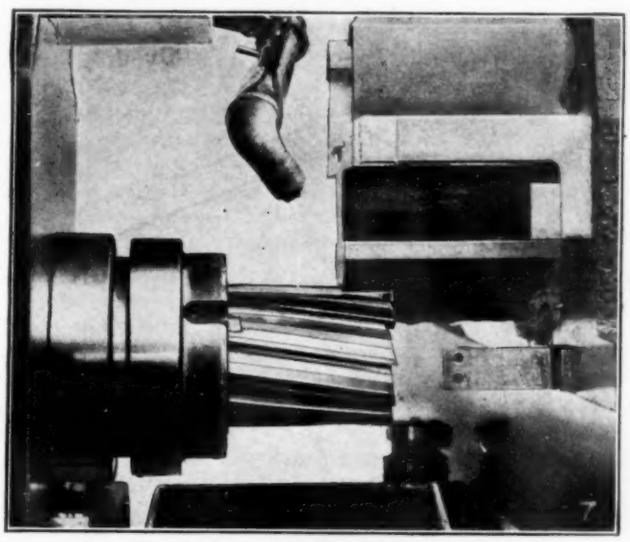


FIG. 17. SLOTTING THE END

Fig. 13 shows operations 5 and 6 which are different only in the shape of the section of metal removed. Operation 5 was done with a relieved cutter held by means of a stub arbor and used as an end-mill. Operation 6 was done in a similar way except that the cutter was made in two parts and interlocking. The reason for this difference was that the surface made by operation 6 had to be corrected within narrow limits, whereas the surface made by operation 5 did not require such accuracy and the variation of thickness of the cutter due to sharpening would not cause trouble. It was found necessary to introduce an extra operation before operations 5 and 6. This operation is shown in Fig. 7 as 4A and consisted of beveling the end of the piece where the cutter is to enter. Without this precaution the cutter was apt to pull itself into the cut, though there was no danger of such a mishap after the cutter had once entered.

A Heavy Milling Operation

Operation 7 consists of removing practically all of the metal from the inside of the forging. This was done on a 24-in. horizontal milling machine, using interlocking cutters. As it proved to be extremely difficult to get sufficient cutters for this operation, and as the first cutters obtained were not correctly made, it was decided to split this operation, for the time being at least, into operations 6A and 7.

It will be noticed that operation 6A can be done with ordinary milling cutters, which of course, could be made in a relatively short time, and without the use of a large backing-off machine. This left much less metal to be removed by the special cutters, and made it possible to do the finishing operation, No. 7, at higher speed and feed and with less wear of cutters than if the entire amount had been removed in one cut. However, if cutters had been available, it would have been more economical to take one single cut with cutters as in Fig. 14.

Operations 8 and 9 are the rough-finish-milling operations along the sides of the piece and around the trunnion, Fig. 15. These operations are similar to operation 2A except that less metal must be removed and consequently a smaller cutter can be used. This operation was done on a No. 5 machine and as the table travel was only 50 in. and the length of the piece to be milled from 69 to 70 in. it was necessary to mount the piece in a sliding fixture. Fig. 16 shows the cutting of the lip of the forging by means of a relieved end-mill. This lip is made of very delicate shape and to men not versed in the mysteries of ordnance design, it would seem that the gun would shoot equally far and straight with a square lip. However, as the design had to be followed, the special milling cutter was used on a No. 5 vertical milling machine and the piece was mounted on a sliding fixture which is quite clearly shown.

Operation 11 requires the removal of a considerable amount of metal; only $\frac{1}{32}$ in. was left on the inside of the forging for finish-planing. This can be seen in Fig. 7. The central guide running lengthwise of the forging limited the size of the cutter, as it was further necessary to make some little allowance for the sharpening of the cutter and the consequent reduction in diameter. This, on account of the forging, limited the stem of the cutter to not more than $1\frac{1}{8}$ in. As it was evident that an arbor of $1\frac{1}{8}$ in. in diameter could not possibly resist such a heavy cut, the arbor was made $1\frac{1}{8}$ in. only at the point where it passed the lip of the forging; while immediately after this point was passed, the arbor widened out and followed closely the outline of the forging so that the portion which was $1\frac{1}{8}$ in. in diameter was only about $\frac{3}{8}$ in. long. This proved so successful that no breakages occurred.

This cut was taken in a No. 5 vertical milling machine using a sliding fixture. Operations 12 and 13 are shown in a general way by Fig. 17. These operations consist in milling off the end of the forging and then milling a gap through the center part. This gap was 2 in. deep at one end of the forging and 4 in. at the other. After these operations, the forgings were 69 in. long while the length between the gaps was 63 in. This operation was done on a No. 5 machine with an end-mill.

An End Key Best Here

In doing such extremely heavy work it was necessary to drive the cutter with a key at the end of the mill rather than with a regular key on a stub arbor. The regular key has a tendency to split the mill. In all these operations the fixtures were provided with setting pieces which were 0.010 in. below the desired surface, and feelers with a thickness of 0.010 in. were used for setting the cut. In cases where it was necessary or advisable to run the machine while setting the cutter, a feeler of copper was used. However, this was avoided as much as possible for safety's sake. In all milling operations large amounts of cutting compound were flowed over the cutter.

Internal Lapping and Laps

By Gustave A. Remacle

I have read with interest Mr. Pusep's article on internal laps, published on page 712, Vol. 51, of *American Machinist*, and the present article is largely supplementary to his treatment of the subject.

The simple lap mentioned by Mr. Pusep and here shown in Fig. 1 may be used for enlarging a hole where accuracy of form is unimportant. This type of lap is most often used for lapping dowel-pin holes which have become smaller in hardening. For such work a small degree of inaccuracy in the form of the hole is of little consequence and since this simple lap can be made cheaply, the use of it for this purpose is general. I use a hardwood wedge in preference to one of metal, because wood is elastic and elasticity makes for speedy lapping, though at the expense of accuracy.

For the purpose of lapping long holes which must

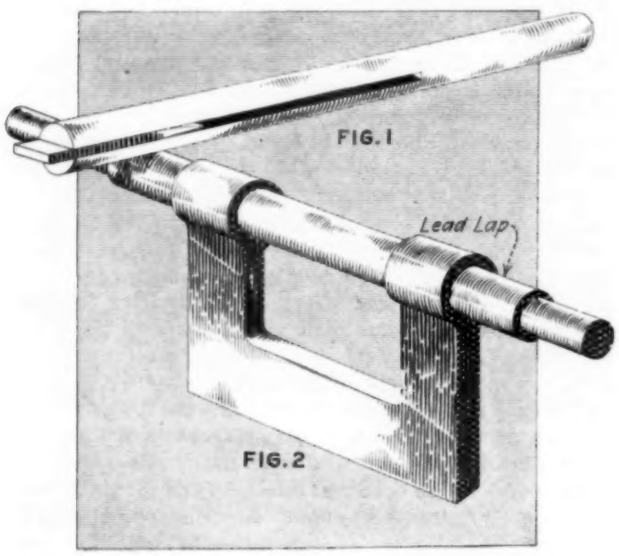


FIG. 1. COMMON TYPE OF SMALL LAP
FIG. 2. LEAD LAP WITH MANDREL

possess no bellmouth, or for the purpose of lapping a piece of such form as the piece shown in Fig. 2, lead laps are best suited. When I speak of a hole as having no bellmouth, I mean such holes as are required in gage work.

The type of lap shown by Mr. Pusep on page 712, Fig. 2, is, as he claims, excellent for removing metal. It should not be used for gage work however, because the springiness of the lap has a strong tendency to produce a bellmouth.

In Fig. 3 is shown a type of lap which I use when lapping gages, the diameters ranging up to $\frac{3}{8}$ in. The size of the lap and the facilities at hand determine which of the three forms is to be constructed. If the shop facilities permit, I prefer making the lap at *A*.

This lap contains three slots. The wedge is made of drill rod and tapered like a needle. The slots should be quite long, say, $1\frac{1}{2}$ in. for a lap $\frac{1}{4}$ in. in diameter. A small hole is drilled to a depth beyond the farther extremity of the slots, and a larger hole, which is a sliding fit for the rod of which the wedge is made, is drilled to a depth indicated at *a*. It will be noted that point *a* is midway between the extremities of the slots.

When I cannot slot the lap with a circular saw, I make it as shown in *B*. In this case a jeweler's saw is used for cutting a slot through the center between the two cross holes. When the lap is of such size that a hacksaw may be used, I make it as shown at *C*. In this instance I slot from the end of the lap and put on a collar to hold the ends together.

For laps *B* and *C* there is only one hole drilled for the wedge. This hole is drilled to point *a* and the wedges are made of drill rod filed on the end to a wedge shape.

When holes must be precisely located and accurately lapped as to form, or when very small or tapered holes must be lapped, I revolve the piece in the lathe and grind or lap them with a diamond charged lap.

In closing I wisn to touch upon the subject of terminology in relation to grinding, lapping and stoning. When discussing these subjects I am often at a loss as to which term to use. If I wish to sharpen a threading die, and I hold the die in a vise while rubbing a carborundum stone on it, I am stoning the die. If

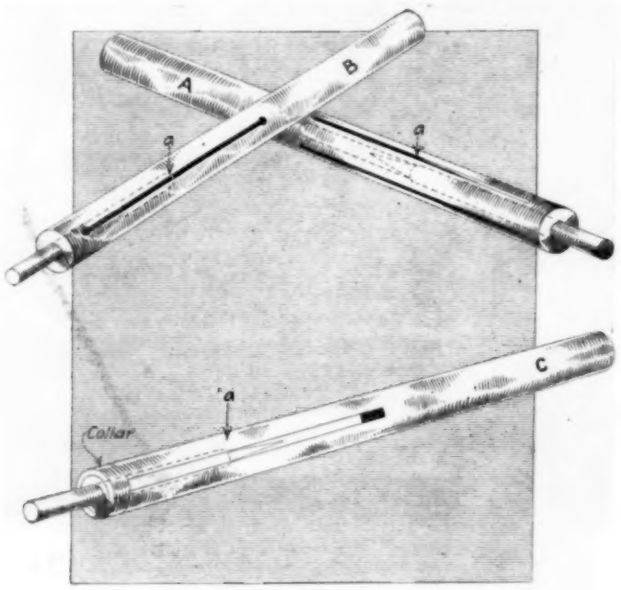


FIG. 3. VARIOUS FORMS OF LAP FOR SMALL HOLES

I hold the die in the bench lathe and mount the same carborundum stone in a grinding attachment, am I grinding or stoning?

When I charge a lap with diamond dust and revolve it rapidly while applying it to the job, am I grinding or lapping? An emery wheel, when revolving and applied to work, is grinding; but I have seen mechanics apply a piece of broken grinding wheel to a piece of revolving hardened steel; in such instance, were they stoning or grinding? And, if an oilstone were applied to a piece of revolving steel, would the act be termed, "stoning?"

Holding Slip Bushings

By Henry R. Bowman

I note the criticism by Mr. Freeman on page 326 of the *American Machinist* regarding the method of holding a slip bushing by means of a capscrew.

In a box jig it has always been the custom in my experience either to cast feet on the corners of the jig body and machine them, or spot face to a uniform depth with an end mill and provide buttons to act as feet. The height of the feet should be enough to give clearance between the table and bushing heads, cover plates, straps, etc.

Some Operations on Caramel Knives

By DONALD A. HAMPSON

This article describes the methods adopted for getting out a job that was a little out of the ordinary, using only such equipment as was available in the shop, together with a few fixtures and devices that could be made in the toolroom from parts of discarded machines.

OURS is what is called a small shop—one of those that is supposed to be capable of handling any kind of manufacturing or special work at the same price (or less) as the big fellow, for the same quality of work. Naturally, one must resort to ways and means to keep tool charges down, for there is never a certainty of a repeat order.

The job in question was the making of knives for a caramel-wrapping machine; said knives, despite the comparatively soft nature of the material they cut, having a rather tough proposition with which to contend, and they have to be made very accurately and tempered with extreme care in order to make them stand up to their work.

Fig. 1 shows the knife, 24 of which constitute a set. They are held by the shank in a cutter head so that the cutting edge is vertical, and the caramel is forced out between the parallel adjacent sides of a pair of blades, each pair in turn doing the work. In the operation there is not only the direct thrust of the cut but a side strain as well. The knife is made of Intra steel.

The first step in the manufacture is to cut off the sections from the bar steel. A dozen bars are placed in a vise and two dozen pieces severed at a cut by using three saws on the arbor of a milling machine. The use of wide saws was found to be a measure of economy because they do not "run," that is, creep to one side under the forcing of the cut, and because they cut squarely across the pieces are all alike and to exact size, which is of importance in subsequent machining operations. When thin saws are used there is a saving of steel in the first place but this is overbalanced by a single cut which runs a few thousandths and thus condemns 20 pieces.

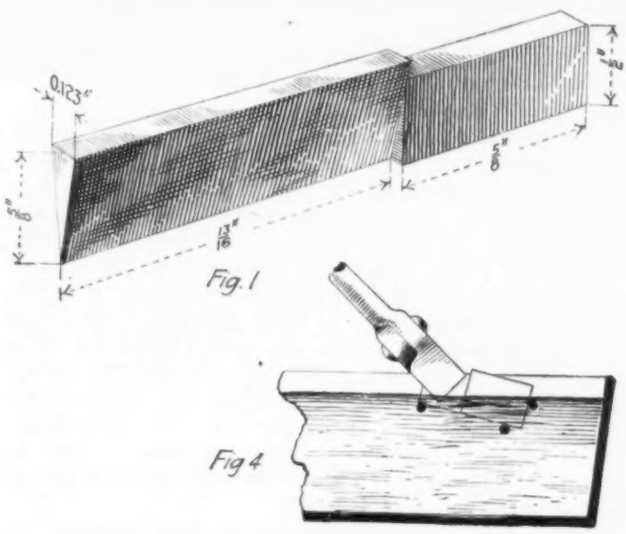
Tool-steel bars vary considerably in all dimensions, a fact that affects these knives in the thickness of the shanks, which must be to exact measurement in order to enter and yet fill the slots in the cutter head, and they must be flat so that they may be rigid under working stresses. These requirements cannot be met by the unfinished bar nor by any rough-grinding or offhand methods, so the process naturally adopted is milling.

Fig. 2 is an illustration of the fixture and set-up for this work. The only part not shown is the pair of 4-in. straddle-mills. These are collared to mill the pieces to exact size, 0.123 in., and once set up correctly the thickness can be forgotten for the next five thousand pieces; even the boy that loads the machine cannot make them vary in size.

The rotary magazine of the fixture is mounted on a 2-in. shaft set in substantial bearings with liberal surfaces to maintain the fit endwise. The shaft is rotated by the worm and gear shown, the drive being through the pulley and belt from the countershaft. It will be noticed that the regular table-feed belt is off; the table is locked in such a position that the passage of the blanks between the straddle-mills machines a little more than enough for the shanks. Setscrews for fastening the knives in the magazine are located on the side away from the observer. The boy who runs the job is provided with a socket wrench (and nothing else) to fit the screws, and he takes out each finished piece as it appears and sets in a blank. Each blank rests against a pin, locating it for depth, and is confined against the thrust of the cut by the sides of the slots cut in the ring.

The blanks projecting from the ring may be readily seen in Fig. 2 and while at first glance it might seem that there was much waste space between each pair, the output has been so satisfactory that there has been no attempt to make any change.

When the pieces are milled on the shanks and to exact length, these two known surfaces are used to



FIGS. 1 AND 4. SHAPE OF THE CARAMEL KNIFE, AND METHOD OF QUENCHING

work from in milling the blade. A fixture was made for each of two machines that are set close together, so arranged that one operator has a working, or rather a storing, table in proximity to both. One machine mills the first taper side and the other the second side—an arrangement that gives 15 knives to each round trip, and the operator has time to do the necessary burring.

This milling brings the blade down to a thickness of $\frac{1}{64}$ in. at the edge, with a limit of a few thousandths less. The thickness at the edge has to be maintained very near the "set" point or the metal will tear out under the cut and at that the cutters need sharpening every day in order to do the cleanest work.

Considering the nature and shape of the piece, this milling cut is quite heavy and ample means of holding the knife against it must be provided. In the fixtures, a clamp abuts against the end of all the blanks, drawing them tightly against a shoulder at the other end. Over the shanks a strap, with notches at the

proper angle, is laid, with a thin strip of soft packing under it holding the blanks down securely. The working floor of each fixture is formed by two cast-iron strips, one each of the width of the shank and the blade, and each having notches of correct space and angle to support the shank under the clamp and the blade under the cut.

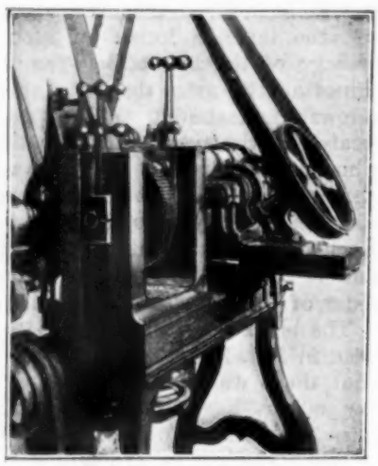


FIG. 2. SET-UP FOR MILLING THE SHANKS

Fig. 3 shows the gas furnace used for hardening, and the way in which it was arranged to make the work convenient. Set up at a good height, it allowed the tank for the quenching to be placed beneath at a height that shortened the time from fire to water to a minimum. Burners on each side of the furnace heated a double row of blades as fast as a man could handle them, and fixtures on the hearth located the blades so that the heat struck the thick backs first.

The quenching tank is 6 in. deep and is filled mostly with water; this gives a good body of coolant and supports one-eighth of an inch of fish oil on the surface which the blade passes through as it is dipped. As shown by Fig. 4, rods in the tank locate the piece while it is being dipped and the level of the oil and water is maintained to the right height to give the hard edge with soft back so much desired—a hard edge for all reasonable wear of the blade, supported by a tough back and shank. This arrangement of an oil film on top of water has worked out very nicely, supporting the theory of its use in furnishing a liquid of oil tempering qualities which the blade strikes as it comes from the furnace and through which it passes to the water which cools it off.

Lacking pyrometer equipment, it was necessary to experiment and, from the results, to simplify the regulation of the furnace as much as possible. Then a conscientious man was trained to judge correct heat by the eye. It was found that the file test was conclusive, supplemented by placing an occasional blade in a vise, held by the shank, and testing the amount of bond it would stand before breaking. No separate tempering operation was performed because none was needed. The body of water in the tank was sufficient to produce uniform results; the hardener guarded against local overheating by moving the blades along the rods as they cooled.

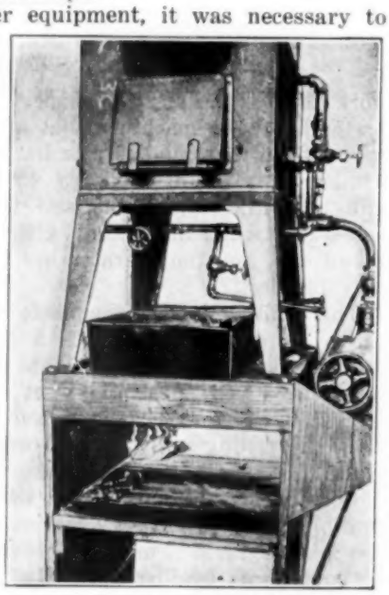
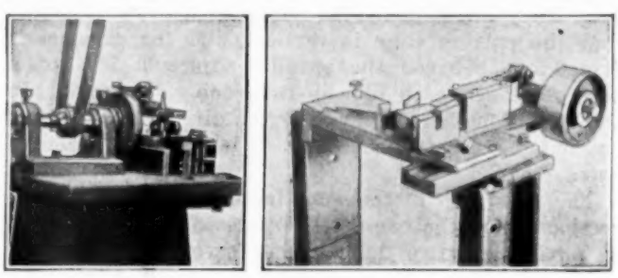


FIG. 3. THE HARDENING AND TEMPERING OUTFIT

After hardening, the blades are given a sawdust bath to absorb the oil and make them ready for the grinding, which latter is done as shown in Fig. 5, by running them over the top of a wheel of 1-in. face. In the illustration, the dresser is set up on the machine for sharpening the wheel and truing it. As the blades are ground to a thickness of 0.004 in. at the edge, the necessity of keeping the wheel in shape becomes apparent and the dresser has satisfied that necessity entirely. It is simply a hardened piece of tool steel with a $\frac{1}{2}$-in. hole through it and having both a thread and flutes cut on its face, producing several hundred points equidistant from the center. The grinding fixture may be raised and lowered so when the dresser is attached to it, it is lowered carefully until the dresser touches the wheel and trues it up.

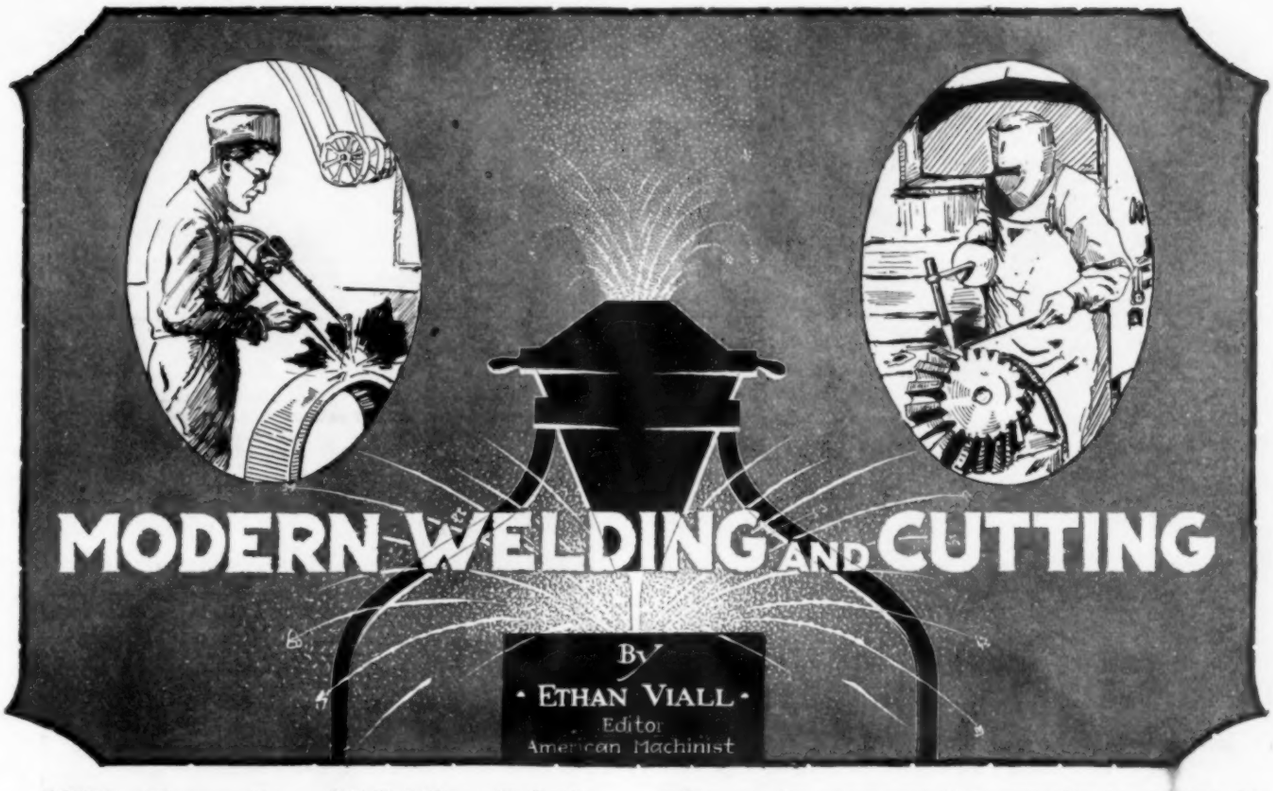
When the dresser is taken off, the fixture presents a flat top, along which a holder, carrying two blades, is moved, each blade passing over the wheel, which just covers the surface to be ground and no more. A few passes over the surface of the wheel grinds away the metal of the blade until the holder passes smoothly along the surface of the fixture, at which point the grinding of that side of the blade is finished. This finger-pressure feeding has proved more satisfactory than might be imagined and as fast as consistent with dry grinding. The finished blades are smooth, straight, and uniform.



FIGS. 5 AND 6. FINISHING OPERATIONS
Fig. 5—Truing the grinding wheel. Fig. 6—Oil stoning the edge by power

Following the grinding, the edge must be stoned to almost razor sharpness. Three-quarter-inch square India oil stones were first employed for this purpose, the knives being held by a special fixture in a bench vise.

An improvement on the hand oil-stoning operation was effected by the construction of the device shown in Fig. 6; this device doubling the production on the most particular operation of the process. It reversed the order for hand work in that the stone moves and the work is stationary. As may be seen, the oil stone is held in a cross-head driven by the crank; the stone traveling between U-shaped guides, on the beveled top surfaces of which is laid the holder carrying one blade. The workman stands before the machine and applies the holder first on one beveled surface and then on the other; his sense of touch quickly tells how much to bear on, greater or lesser pressure being obtained by sliding the holder farther up or down the incline surface. Though skeptical as to the possibility of doing this part of the work by power, all doubt was removed by the time the first dozen blades had been run off.



XIX. Examples of Welding Jobs*

Little attempt is made in this article to explain in detail how the welds have been made as they all come under rules already given. The examples will be helpful, however, in revealing the possibilities of the gas torch as a welding tool.
(Part XVIII was printed in our Jan. 29 issue.)

THE way a crack to be welded is V'd out or plates are beveled, has already been outlined, but it will be well to elaborate a little on the methods of doing this work. On steel or wrought iron, the beveling may be done with a gas cutting torch. On other metals, such as aluminum or cast iron, the gas cutting torch cannot be used, although the metal may be roughly melted away. Sometimes the work is of such a nature that the bevel may be ground, either with a stationary or a portable electric grinding machine. On cast iron, a sledge and a handled chisel is often the cheapest and quickest way, and in nearly every case it is superior to melting the metal away with a gas torch.

A very satisfactory beveling tool for all-round shop work, is an electric or a pneumatic chisel such as shown in use in Fig. 201. This may also be used for taking off surplus metal after welding, although a portable electric grinding machine is usually preferable.

On work like the propeller blade shown in Fig. 202, the slots may be cut with a saw or a milling cutter and the pieces left may be knocked off with a hammer. This bevel might also be chipped, ground or melted off, as the occasion or equipment at hand demanded or made advisable.

An engine cylinder grooved out and ready for preheating, is shown in Fig. 203. In a case of this kind the grooving may probably be best done by using a sledge and handled chisel for the easily reached parts, and a pneumatic chisel for the rest. However, this largely depends on the size of the work and the judgment of the workman. Fig. 204 shows the cylinder welded and ready to be smoothed up.

A badly broken four-cylinder block is shown in Fig.

*For the author's forthcoming book, Welding and Cutting. All rights reserved.

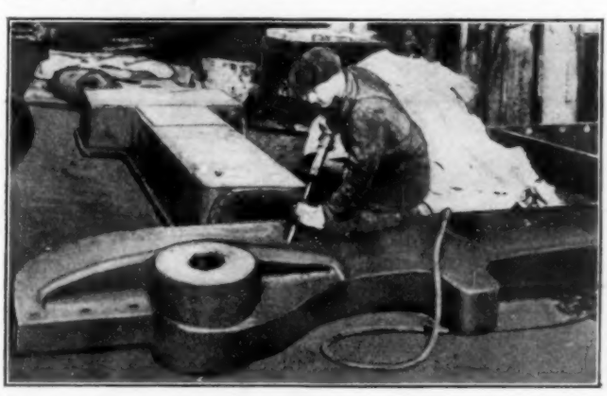


FIG. 201. AN AIR CHISEL MAY BE USED EITHER FOR GROOVING OR FINISHING

FIG. 202. PROPELLER BLADE PARTLY BEVELED FOR WELDING

FIG. 203. CYLINDER GROOVED OUT FOR WELDING

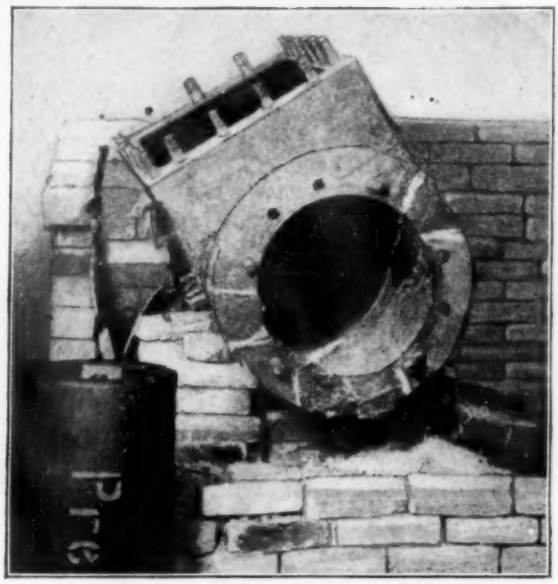


FIG. 204. THE CYLINDER AS WELDED

FIG. 207. WELDING AND PREHEATING

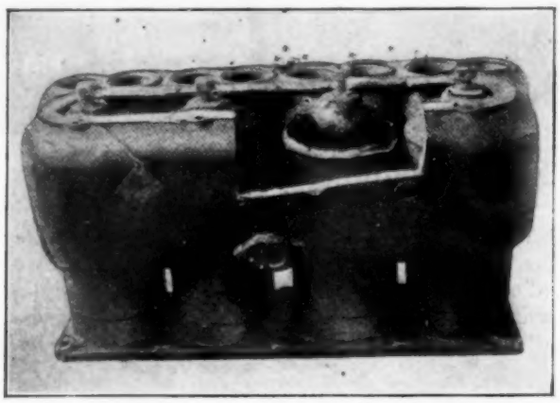


FIG. 205. BROKEN AUTOMOBILE CYLINDER

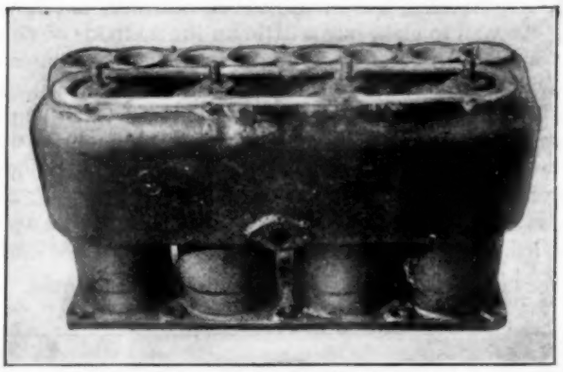


FIG. 206. THE FINISHED WELD

FIG. 211. PREHEATING AND WELDING A LARGE KETTLE

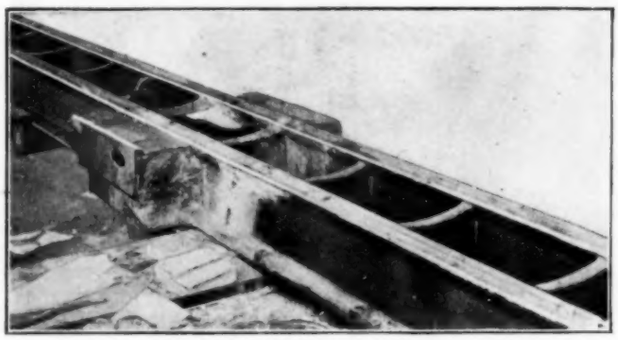


FIG. 213. WELD ON LARGE PLANING-MACHINE BED

205 and the repair, in Fig. 206. The actual cost to weld this job was less than five dollars. The method of procedure has been previously described.

In Fig. 207 a welder is shown working on a job while a helper is tending to the preheating of another. The method of welding through a hole in a large sheet of asbestos not only keeps the heat in, but protects the operator as well.

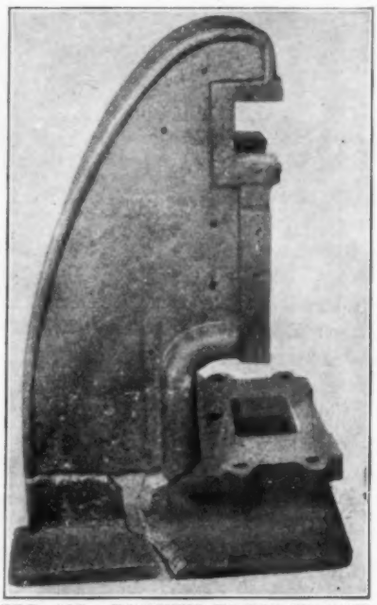


FIG. 217. BROKEN PRESS FRAME WITH BREAKS BEVELED

In Fig. 208 is shown a badly broken aluminum upper crank case and the repair. Work of this kind often comes to the shop that caters to the automobile trade. Another repair of interest to the garage man is shown in Fig. 209. The cost of putting in a new frame in this 5-ton truck would have been at least $600. The weld was finished and guaranteed for $25.

The welding of a tire for a 15-ton truck wheel, 10 in. wide by 2⅜ in. thick, is shown in Fig. 210. The preheating was done in a large blacksmith's forge. In this connection, the welder must get out of his head a very common idea that preheating is only needed to take care of expansion and contraction. It is just as valuable in its way, for saving expensive welding gas. This is the reason for preheating the large tire, since its shape and nature precludes any expansion or contraction troubles provided the welder has even ordinary skill.

In the example shown in Fig. 211, which is a kettle 5 ft. 6 in. in diameter and 1⅛ in. thick, preheating is absolutely necessary in order to take care of the expansion and contraction. The crack was around the outlet and was 22 in. long. The welding time was 1 hr. 45 min., in addition to the time it took to preheat the kettle the required amount.

The welding of a 7-in. crankshaft for a 200-hp. internal-combustion engine, is shown in Fig. 212. The finished weld is shown in the insert.

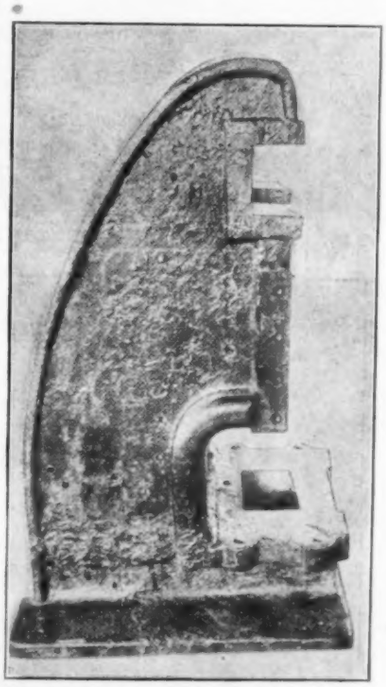


FIG. 218. THE WELDED PRESS FRAME

The work was finished and the crankshaft put back in service inside of 30 hr. The section of the shaft added was oversize to permit machining for alignment. Preheating in this case saved a considerable amount of welding gas. The improvised furnace also made slow cooling possible.

Welding Broken Machine Tools

The planing-machine bed, shown in Fig. 213, was cracked through on one side close to the housing boss. The job was finished without serious disalignment, but under ordinary circumstances such a repair would not be recommended unless means were at hand for refinishing the ways and possibly other machined surfaces. As a war-emergency repair, however, it proved satisfactory. The redemption of a similar casting, damaged while still in the rough, might also be a money-saving proposition in some cases.

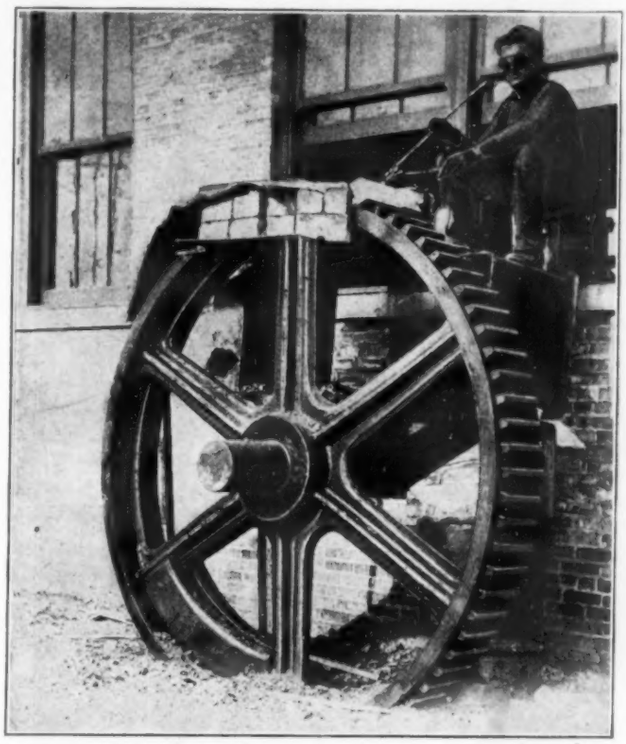


FIG. 220. WELDING TEETH IN A LARGE GEAR

The punch-press frame shown in Fig. 214, outside of its size, does not offer any serious welding difficulties, as any possible distortion can be taken care of by subsequent adjustment. The welds made in this particular case were 12 in. in thickness, and the total time taken to get the press back in service was 38 hours.

The saving of defective castings may often prove a very important item to the shop management. In Fig. 215 is shown a lathe bed, weighing 900 lb., which came from the foundry with sand holes in the pan. These were easily filled up.

Another lathe bed, sand-cracked where the bed leg joined the pan, is shown in Fig. 216. The casting weighed 1,750 lb. and was saved from being scrapped by 27 min. of welding work.

A broken frame of a punch press is shown in Fig. 217. This frame was 4½ ft. high, 2½ ft. wide and from ¾ to 1¼ in. thick. It weighed 500 lb. The welder's time on the work was 8½ hr.; helper's time 8¼ hr.: oxygen used,

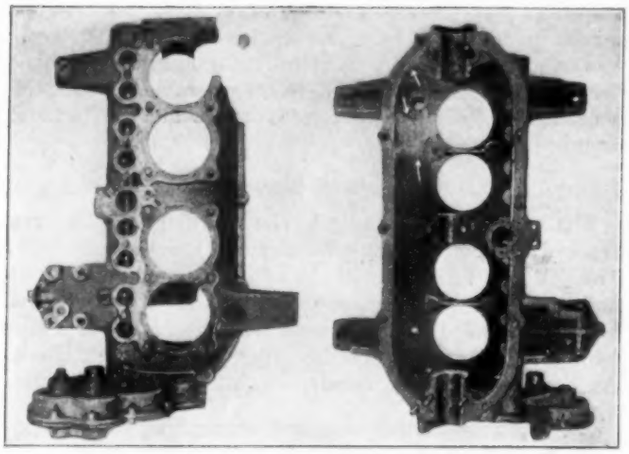


FIG. 208. BROKEN AND REPAIRED ALUMINUM CRANK CASE

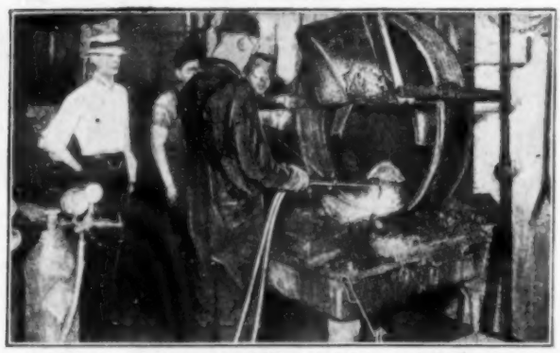


FIG. 210. PREHEATING AND WELDING LARGE TRUCK TIRE

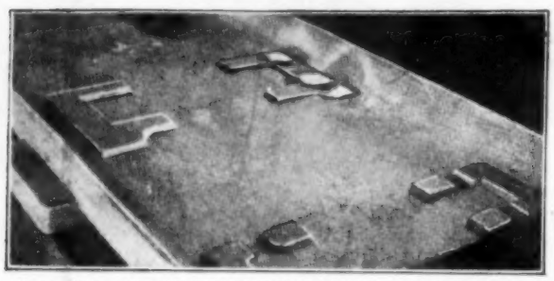


FIG. 215. WELDED BLOWHOLES IN LATHE PAN

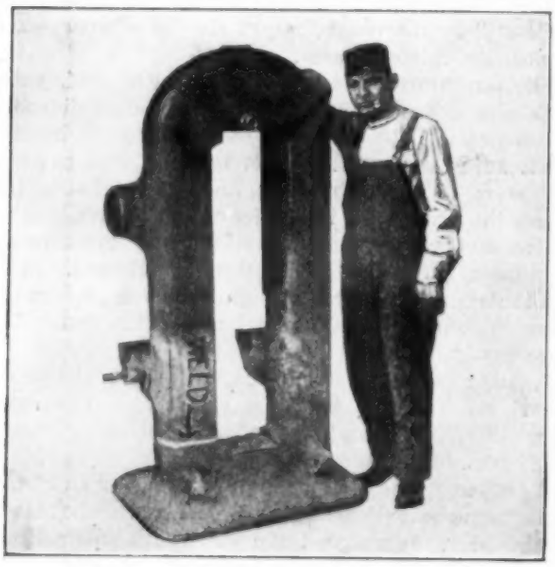


FIG. 219. ANOTHER WELDED PRESS FRAME

FIG. 216. WELDED CRACK IN LATHE BED

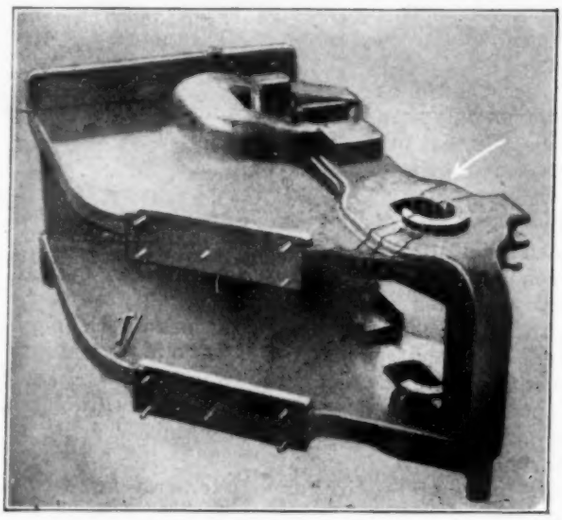


FIG. 214. BROKEN PUNCH-PRESS FRAME

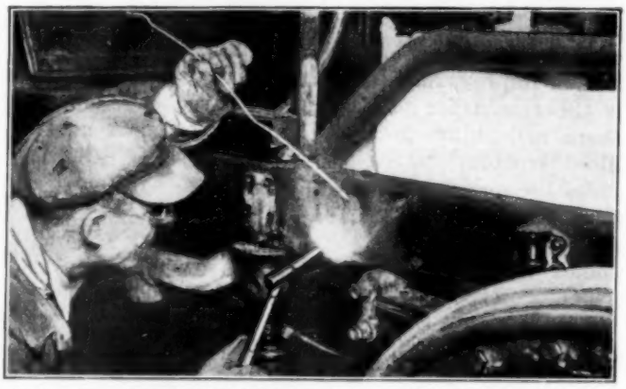


FIG. 209. WELDING FRAME OF 5-TON MOTOR TRUCK

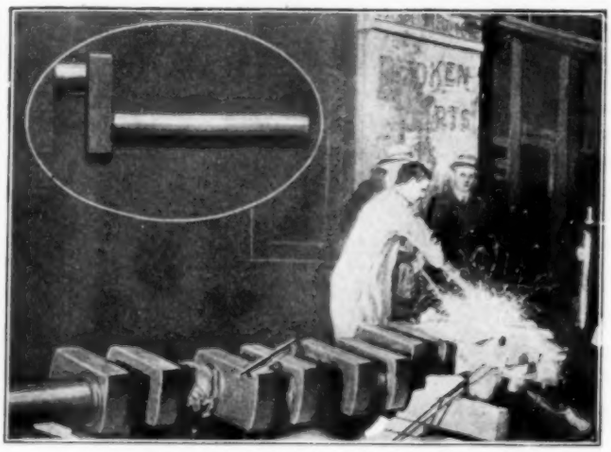


FIG. 212. WELDING A LARGE CRANKSHAFT

425 cu.ft.; acetylene used, 327 cu.ft.; cast-iron filler, 4 lb.; preheating, 4 hr. with gas at a cost of 60 cents. The total cost today can be computed by taking the present cost of labor and supplies and multiplying by the figures given. The finished job is shown in Fig. 218. An Oxweld torch was used.

A much simpler, and in fact almost an ideal piece to weld, is shown in Fig. 219. The frame is 12 x 12 in. at the break.

Ten teeth were broken out of the gear shown in Fig. 220. The gear was 8 ft. in diameter and the teeth 10 in. long, 3 in. high and 3 in. thick. It is seldom necessary to preheat in a case of this kind except to save gas, but care should be taken to keep the heat in as much as possible.

A practical man would at once question the advisability of trying to repair a pulley broken as indicated in Fig. 221. This pulley is 7 ft. in diameter and was completely welded in 12 places as indicated, and ready for service in 48 hr. The work was done so well that the rim ran practically true, except for about ¼-in. side play. This particular case was a war-emergency job, but sometimes such a repair job is of vital importance at the present time, for such a pulley can seldom be replaced by a new one without considerable delay.

FIG. 221. A LARGE PULLEY WELDED IN TWELVE PLACES

In many instances broken locomotive frames may be quickly repaired with the gas torch without dismantling, and the engine put back into service in a short time. Such a repair is shown in Fig. 222. This job took altogether less than 24 hr. from the time the engine was run in until it was on the road again.

The gas torch is almost as useful for welding around a shipyard as it is in a railroad shop. Fig. 223 shows a 4-ton forged-steel rudder frame broken as indicated by the arrows. The break has already been beveled out for welding. The cost was about $60 as compared with about $1,400 for a new frame, and the time taken was a fraction of what would have been required to obtain a new one.

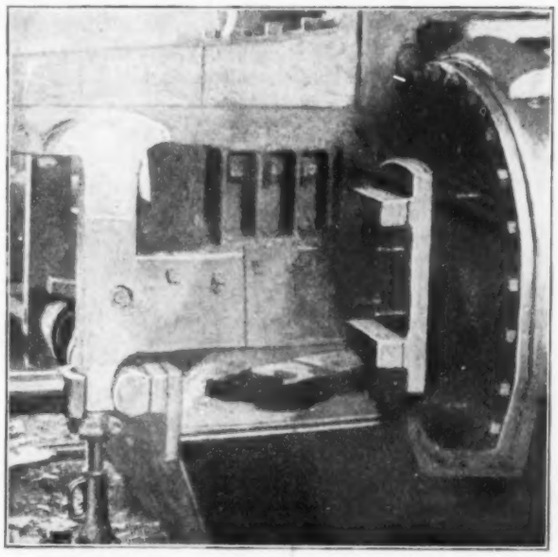


FIG. 222. A WELDED LOCOMOTIVE FRAME

On many large jobs, where considerable preheating has to be done, the discomfort of the welder may cause defective welds or even complete failure. Sometimes asbestos screens can be used; at other times it is necessary to shift welders every few minutes. Two suggestions that may be helpful in certain cases are here given. H. Howard suggests the use of an "air screen" as outlined in Fig. 224. A row of small holes is drilled in a pipe of convenient size to attach to the air hose. The other end of the pipe is closed. This contrivance is placed across under the torch and held by a clamp or a weight in such a position that a curtain of swiftly moving air passes between the hot casting and the operator. The device affords protection from the heat and does not interfere with the manipulation of the torch or obstruct the view of the operator.

This device, while useful for certain jobs, has disadvantages, as it does not follow the movements of the operator. J. R. Cumming suggests the one shown in Fig. 225. A ¼-in. air pipe is fastened to the gas torch by a light iron clip. The air pipe is connected by a light hose to the air supply. By the exercise of a little ingenuity in making this attachment, an operator can keep his hands and face reasonably cool on many jobs that would otherwise make him exceedingly uncomfortable.

The way to prepare seams in boiler and tank welds

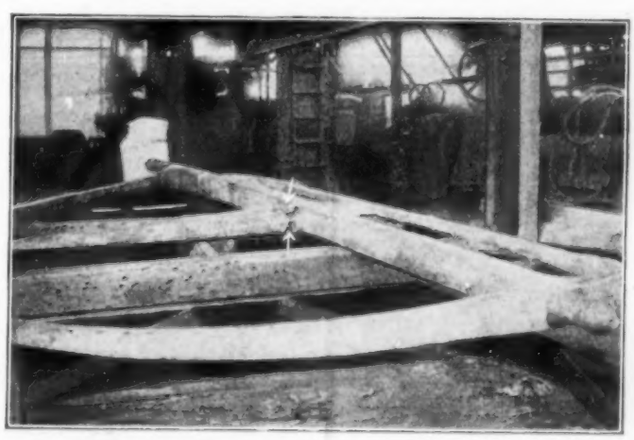


FIG. 223. RUDDER FRAME READY FOR WELDING

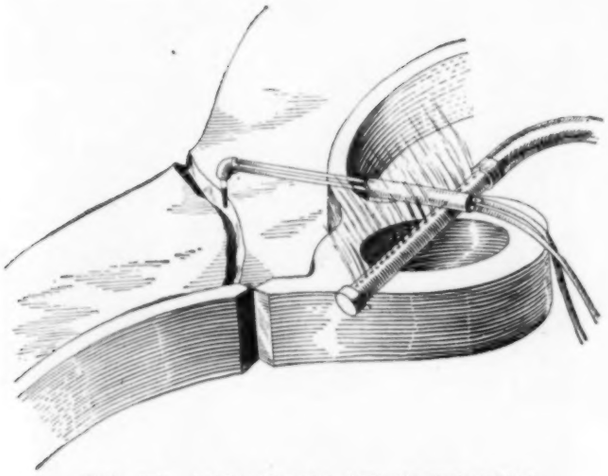


FIG. 224. COOLER FOR USE IN WELDING

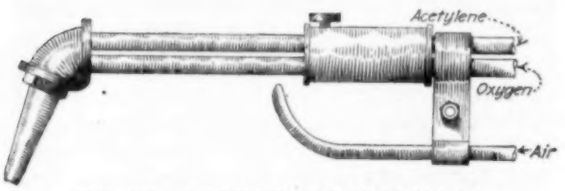


FIG. 225. ANOTHER COOLING DEVICE

has already been shown, and only one example will be given. Fig. 226 shows a tank which in use has to stand a pressure of from 200 to 300 lb. It is 4 ft. in diameter and 5 ft. long. The shell is made of $\frac{5}{16}$-in. plate and the dished bottom of $\frac{3}{4}$-in. plate. The longitudinal seam is welded, and the bottom welded to the shell in 6 hr., at less than the cost of riveting, and no caulking is needed

There have been extensive tests on the strength of gas-torch welds on boiler plate and the following results are given by the Oxweld Company:

No. of Specimen	Dimensions	Area in Sq.In.	Breaking Load	Stress per Sq.In.	Efficiency of Weld
1	1.522x0.393	0.598	25,130	42,000	84%
2	1.554x0.380	0.592	23,000	42,800	86.6%

This efficiency is figured on the basis of 50,000 lb. per square inch as the ultimate tensile strength of the material, elongation $\frac{3}{16}$ of an inch in 2 in. as welded, or about 9.3 per cent.

The average of a number of similar tests taken at random from a considerable list was 79 per cent.

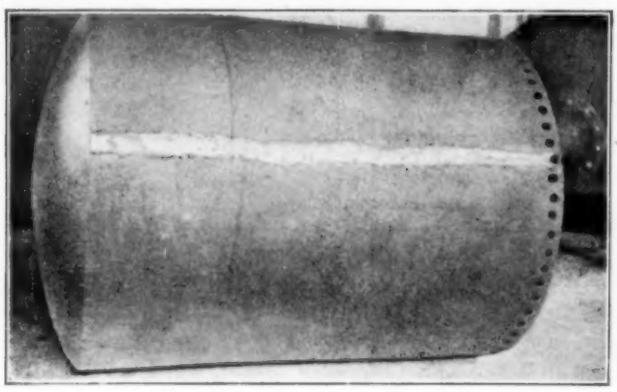


FIG. 226. A WELDED TANK

A comparison between the cost of welding and riveting shows that up to certain thicknesses of plate, notably $\frac{3}{8}$ in., welding is cheaper per lineal foot than riveting. On heavier material than this, however, the cost is usually about the same as good riveting practice.

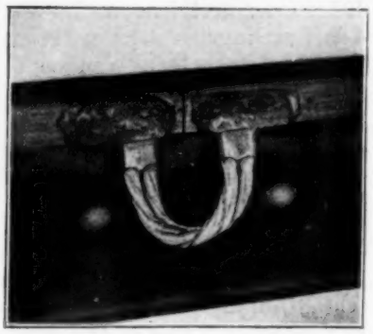


FIG. 227. ELECTRIC RAILS AND WELDED ON BOND

The speed and cost per foot of welding with an Oxweld torch for different thicknesses of plate are:

Thickness of Metal, In.	Lin.Ft. per Hour Welded	Cost per Foot
$\frac{1}{8}$	20	$0.04
$\frac{3}{16}$	15	.06
$\frac{1}{4}$	10	.09
$\frac{5}{16}$	6.5	.23
$\frac{3}{8}$	6.0	.27
$\frac{1}{2}$	4.5	.35
$\frac{3}{4}$	3.0	.60
1	2.0	1.20

This table is compiled from results obtained from actual shop practice. The price of oxygen is figured at 2 cents per cubic foot, acetylene at 1 cent and labor at 30 cents per hour. Other gas and labor costs can readily be substituted to meet any local conditions.

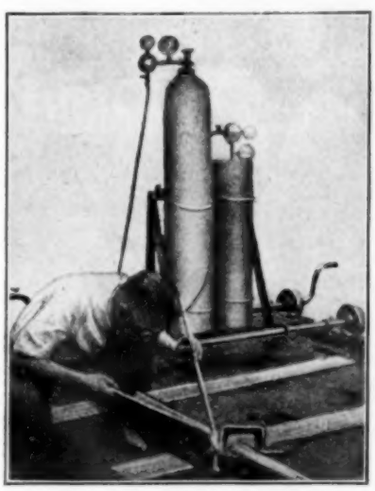


FIG. 228. BOND WELDING OUTFIT IN USE

Electric rail bonding, such as shown in Fig. 227, is very easily done with the gas torch. Fig. 228 shows a welder at work on a job of this kind. The apparatus used is mounted on a special truck so as to be easily moved along the rails from one joint to the next requiring bonding.

FIG. 229. BUILDING UP WORN PARTS OF LARGE PUMP

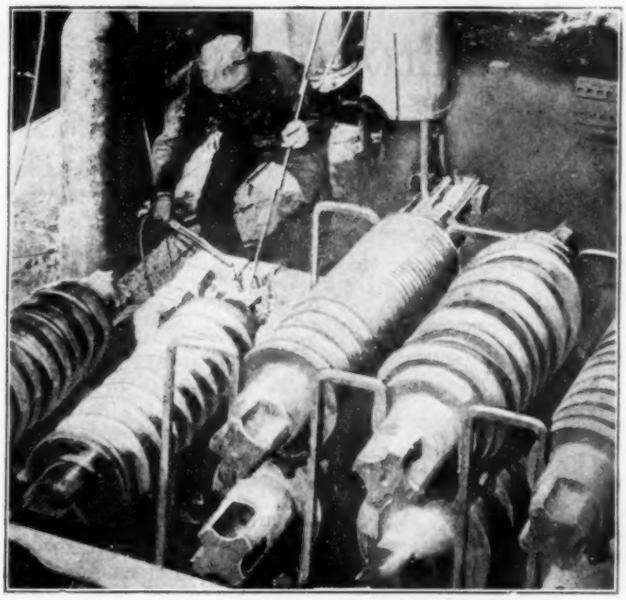


FIG. 230. WELDING PODS ON STEEL-MILL ROLLS

The filling up of blowholes, cold shuts and cracks in castings of various kinds is well known to most foundry workers, but the building up of worn or over-machined parts is not so familiar to the general run of mechanics.

A good example of the reclaiming of an expensive casting worn in service is shown in Fig. 229. This is the casing of a circulating pump. A strip of metal about 3 in. wide and $\frac{3}{4}$ in. thick had to be built up around the entire inside edge of the casting. The work was done by two operators working as shown. The added metal was then ground smooth enough for the purpose and the casing put back in service.

Building up worn pods on steel-mill rolls is shown in Fig. 230. A rough brick furnace is built around the end to be welded and charcoal used to heat up the work to save gas. The welding in this case was done with thermalene, but any good gas outfit may be used with goods results.

The large chain belt links, Fig. 231, were cut undersize on the corners and were reclaimed by building up as shown.

Aluminum automobile transmission or other castings often come through slightly defective. To recast them would mean a duplication of costs in cores, molds, handling and turning, which would mean a considerable loss. They are welded—the holes filled with similar metal from a "filler-rod" as shown in Fig. 232—at a cost of but a few cents each and they pass inspection as being as good as perfect castings.

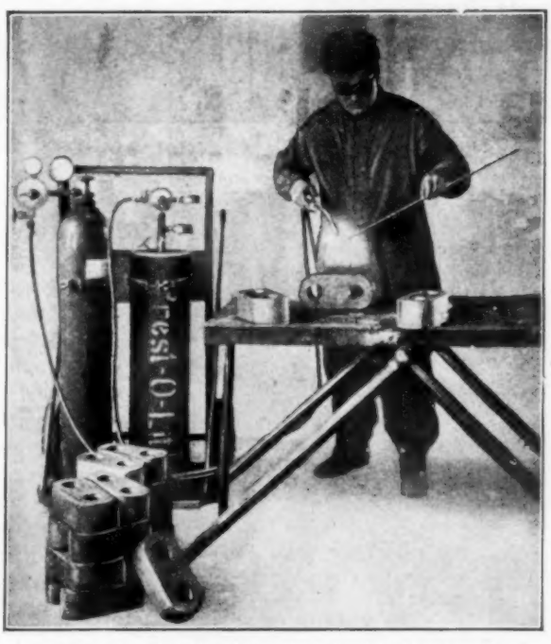


FIG. 231. BUILDING UP OVER-MACHINED CHAIN LINKS

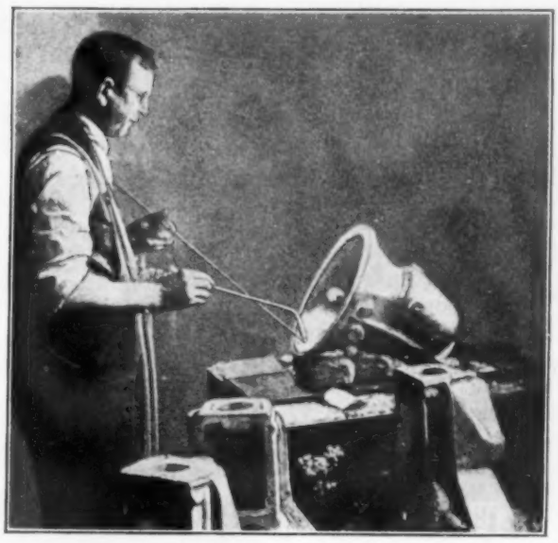


FIG. 232. FILLING BLOWHOLES IN AN ALUMINUM GEAR CASE

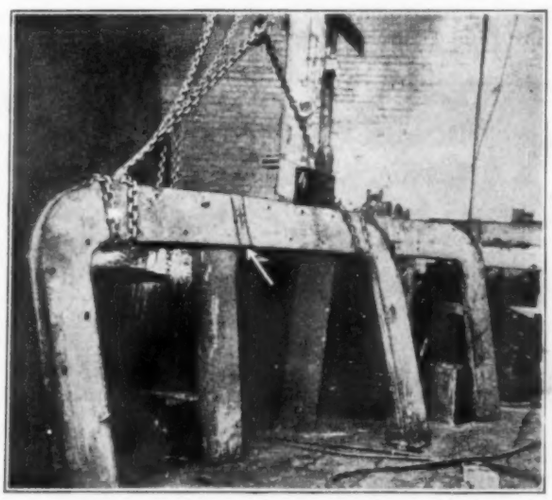


FIG. 233. BRASS RUDDER FRAME SALVAGED BY WELDING

Through error four cast-brass U-plates for rudder frames, Fig. 233, weighing 1,000 lb. each, were made 6 in. too long.

To repour these plates would have held up some important work and the expense, including change of pattern, would have been very high. The mistake was quickly and economically corrected by cutting 6 in. out of each as shown by the illustration and welding the frames together again.

Machining Rudders for Troopships

By ALBERT FISCHER

In the building of ships during the late war, emergencies arose that necessitated the production of certain complete components at places far distant from the point of their assembly. In this article the author tells in detail some of the methods used in making the cast-steel rudders for 8000-ton troopships in a shop located more than 350 miles from the yard where they were built.

THE rudders for the 8000-ton, Class B troopships built at Hog Island, Philadelphia, Penn., were steel castings, each rudder being composed of two castings, an upper and a lower riveted together. The machine work on both parts of the rudders was done at the plant of the Turner-Fricke Manufacturing Co., Sharon, Penn.

The first operation on each of the parts was to place them on layout tables and line them up in the usual way to determine whether they were straight and would finish to the dimensions called for at the places to be machined. If they were all right, the customary lines were marked on them for the guidance of the workmen in future operations. The upper half was mounted on a large floor boring and milling machine, Fig. 1, and the surface milled off, leaving the long key or tongue *A* an integral part of the casting.

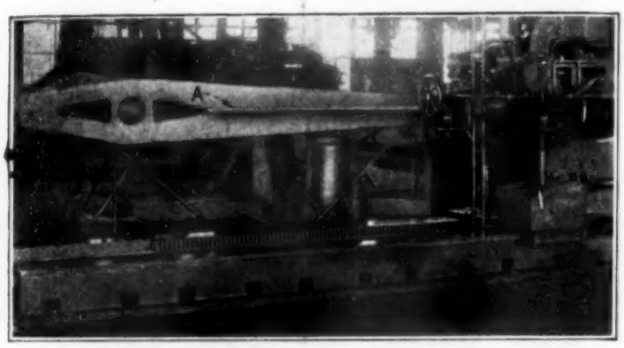


FIG. 1. MILLING THE UPPER HALF OF THE RUDDER

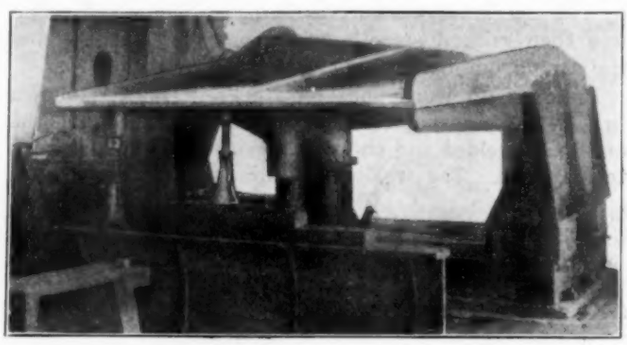


FIG. 2. SET-UP FOR BORING THE RUDDER-POST HOLE

The hole for the rudder stock was bored taper at the top of the casting and straight at the bottom, and as the tapered part was on the other end it was necessary to reset the casting for this operation. As the machine used for facing the joint was already set up for that operation, and as another like machine was included in the shop equipment, it was deemed best to transfer the work to the second machine for the boring operation and use the first machine, as set up, for machining the joint on the same part of the next rudder.

The set-up for boring the rudder-post hole is shown in Fig. 2. This operation also includes counterboring for the spacing ring, machining the seat for the nut and laying out the center bore for the keyway. Fig. 3 shows the boring machine and the bar used.

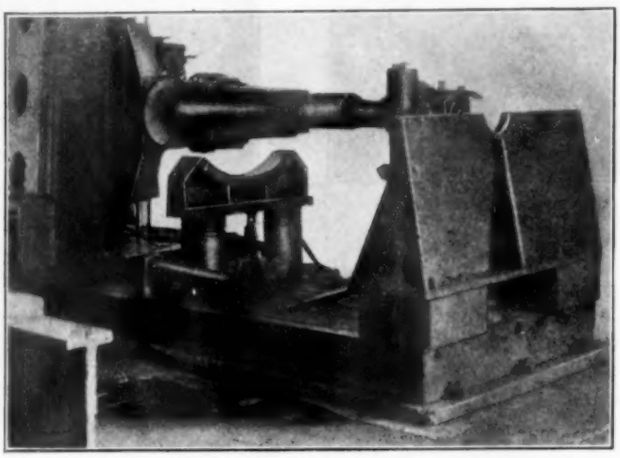


FIG. 3. THE MACHINE AND BAR FOR BORING THE RUDDER-POST HOLE

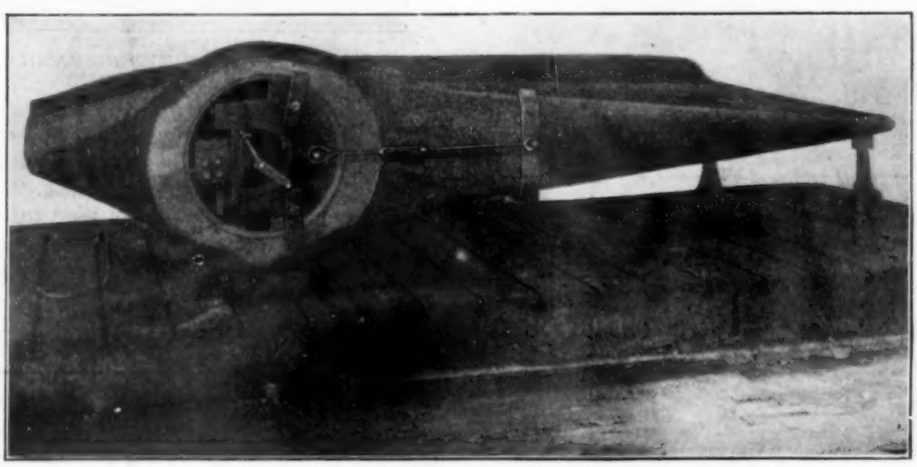


FIG. 4. RIG FOR CUTTING THE KEYSEAT

For cutting the keyway, the work was placed on a large floor plate, Fig. 4. A planing fixture was inserted and clamped in

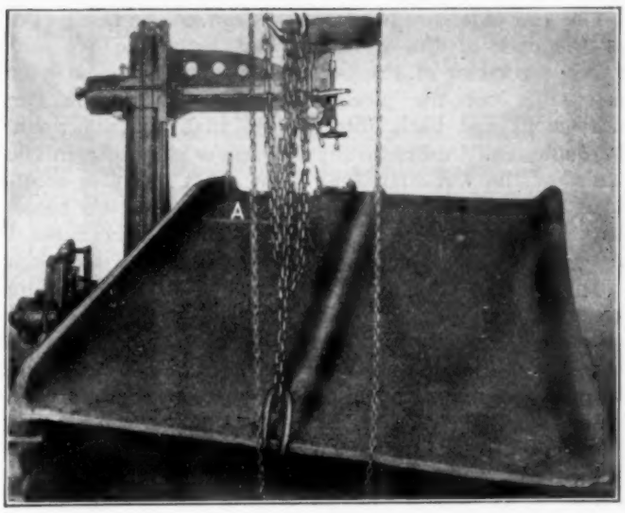


FIG. 5. DRILLING FOR THE COVER PLATES

the hole, and the tool-carrying ram driven from the platen of a 24-in. planing machine placed in the rear, connection for driving being made between the two by a rod.

As cover plates to protect the nut were required and were to be attached with thirty-two ¾-in. Navy-bronze screws, a further operation of drilling and tapping was necessary. This was done in a radial drilling machine as illustrated in Fig. 5, in which one of the cover plates can be seen at *A*.

Drilling and Countersinking

Drilling and countersinking the eighty 1¼-in. rivet holes in the flange was done in a radial drilling machine, Fig. 6, in which the jig used is shown at *A*. This jig is also used for drilling the lower half of the rudder, being made reversible for that purpose. As the casting was too high to go under the arm of the drilling machine, a pit of the necessary depth was dug alongside and the casting lowered into it.

The lower half was laid out, as previously described, and the joint machined on a 60-in. planing machine. As this machine was not wide enough to allow the work to pass between the uprights, one of them was removed and the end of the crossrail blocked up. Planing was done by the side head attached to the upright that was left in position.

The whole arrangement will be apparent from a glance at Fig. 7. Other operations on surfaces to fit the upper half of the rudder are the same as performed on that part and need no further description.

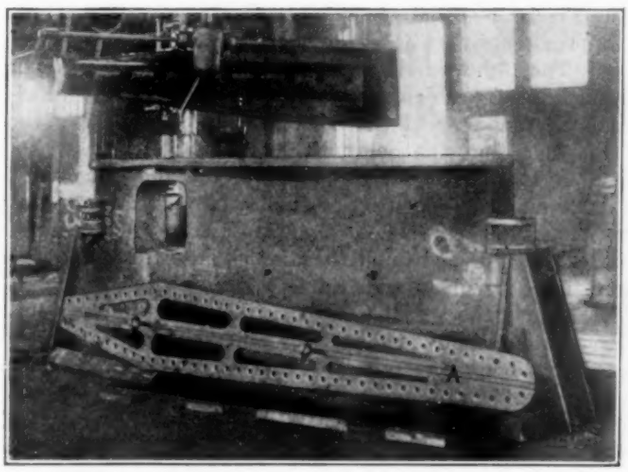


FIG. 6. DRILLING AND COUNTERSINKING RIVET HOLES

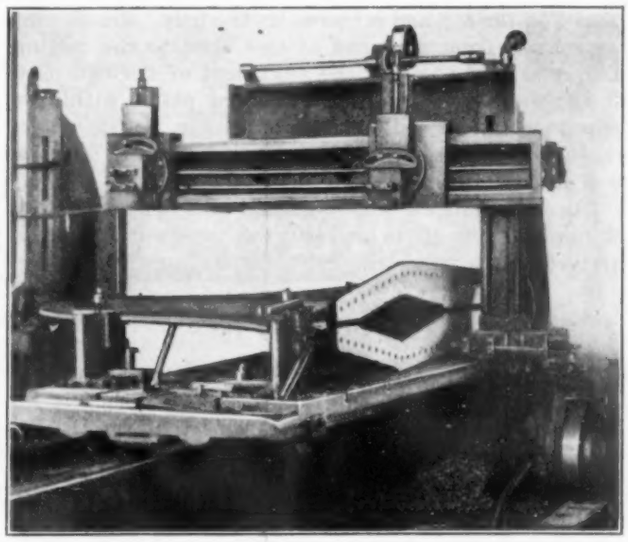


FIG. 7. PLANING THE LOWER HALF OF THE RUDDER

Referring to Fig. 8, the rudder is here shown assembled for inspection. The lower half was stood up in a pit provided for the purpose and after being leveled by the machined surface was braced by the adjustable struts as shown. The upper half was placed in position and the two parts bolted together with bolts through the rivet holes in the flanges.

A plumb line was dropped through the rudder-stock hole and centered by spiders in the usual manner. This was used to check the squareness of the machined surface in relation to the hole. A straight-edge long enough to extend over both ends of the rudder was then

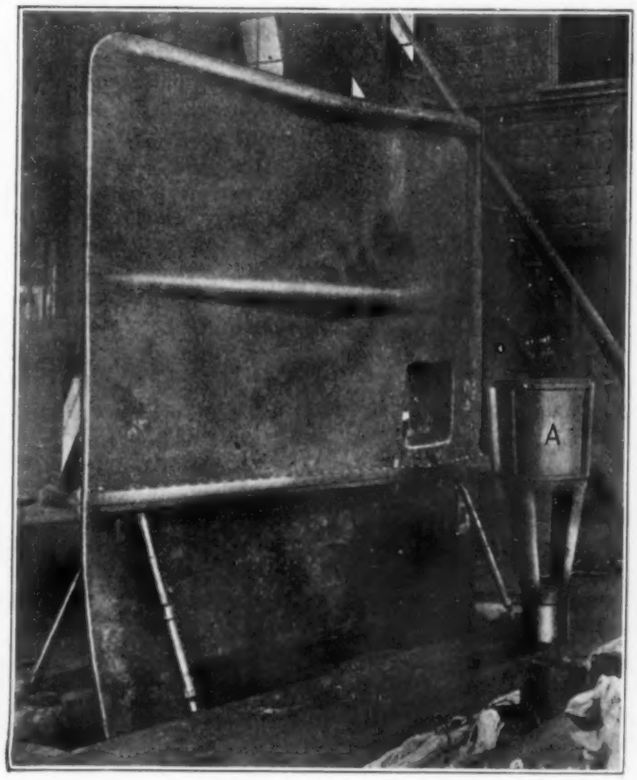


FIG. 8. THE RUDDER ASSEMBLED FOR INSPECTION

placed on the top and centered by the hole. Plumb lines were hung from each end of this close to the casting. This was used to check the alignment of the two parts and to show if the rudder would hang plumb within the requirements. Finally the gage *A*, Fig. 8, was put in the hole to check both the taper and straight holes as well as the size and position of the keyway.

For convenience in handling, the rudders were shipped in two parts and riveted together after they arrived at the shipyard.

Day-Work *versus* Piece-Work

BY W. D. FORBES

Not long ago a man said to me, "Smith's shop is run on the day-work plan and he tells me that for the last year he has turned out more work that way than he would have done had he been doing piece-work." Now, I am not well acquainted with Smith's shop, but I know that it is a manufacturing proposition; in other words, the work is repetition production, and I am sure that while the men are paid by the day they are, as a matter of fact, doing piece-work camouflaged.

If I were to go to that shop I know I would find that while there might be no piece-work there would be a very clear understanding that the work on the various parts to be made must not take longer than a certain amount of time, and if a workman did not get out the work in the prescribed time he would not stay in the employ of Smith.

The difference between making and manufacturing is too well understood to be discussed here, as far as the actual work goes, but the real difference is shown in the balance sheet. That is, "making" is a proposition that may or may not be profitable, and whether it is or not is generally not known until too late. On the other hand, "manufacturing" on a piece-work system allows the balance sheet to show if a profit will be made or not. To put it in another way, piece-work gives a known condition while day work makes for uncertainty.

Of course, if work is being done for a customer at day-work rates then the amount of work done by the men will, or should, show a profit, but a day-work system for manufacturing is just as bad as the absurd "cost-plus" idea that our Government entered into during the war. The assertion that Smith's shop was doing better than it had been, does not by any means mean that the shop was doing a fair amount, nor does it follow that it would not do better if the piece-work system was introduced and properly carried out.

The unions object to piece-work on the mistaken ideas that a man will work so hard under the system that he will break down early in life, and that in doing a big day's work he puts someone out of a job.

In some trades there can be no doubt that a man can overexert himself to his permanent injury, but in the machinist's trade this is not possible. Physical effort is not necessary in machine-shop work today; yet there is a very clear effort to make people believe that because a machinist turns out a lot of finished work in a day that he is all tired out.

No matter how hard a machine tool works, the runner of it does not have to turn a hair. Sitting or standing at a lathe or planer takes a certain amount of strength, but for a man in good health the only strain is that of monotony, and we can not get entirely away from fatigue if we have to work for a living.

The real objection to piece-work can not be fairly laid at the door of the workman, but rather to the outrageous conduct of short-sighted proprietors who have constantly cut the piece-work prices, even when an agreement had been entered into that no cuts would be made, and this naturally engenders a feeling in the heart of the workman that he will not get fair treatment. Conditions often arise to make it absolutely necessary to reduce piece-work prices, and in such cases I have found workmen perfectly willing to accept a change. They do so, however, always with the feeling that they could not hope for fair consideration if new conditions were to arise which would justify an upward change. It is always a downward change for the workman, so as a matter of precaution he keeps some force in reserve to use when it comes to a pinch. With this feeling it is evident that no peak production can be obtained and maintained. I will assert that no manufacturing shop, run as Smith's shop is run, is making its proper output.

Charts for Design of Tension Bolts and Screws

BY GEORGE W. CHILDS

Referring to the article under the above title by Captain H. M. Brayton on page 890, Vol. 51, of the *American Machinist*, I do not agree with the Captain's statement, "I believe the chart shown in Fig. 2 should be on every engineer's desk." It would be interesting to me to know how many designers and engineers will follow his advice and make one. I believe that the majority of men in the above professions can compute mentally close enough for all practical purposes the total load a bolt will withstand, knowing the fiber stress of the material in pounds per sq.in. of which the bolt is made. I am also of the following opinions:

1. That a majority of the men in the professions named carry in their gray matter the number of threads per inch for each size of bolt generally used in machine construction.

2. They know that the depth of a U. S. standard thread is equal to three-fourths of the pitch of the thread.

3. Knowing the above they are capable of computing quickly and close enough for nearly all purposes the diameter at the bottom of the thread.

4. They also know that the diameter at the bottom of the thread is equal to the diameter of the bolt minus (approximately) 1.3 $\times$ pitch of thread.

5. They know how to compute the fiber stress per square inch to which the material will be subjected, having the diameter at the bottom of the thread and the total load that the bolt will have to withstand.

6. If they cannot do any or all of the above mentally, quickly and close enough for all purposes, they know that nearly every engineer's handbook contains tables of bolts and nuts in which the diameter at the bottom of the thread is given and the rest is easy.

I believe the majority of draftsmen, designers, etc., have among their data sheets a blueprint table of U. S. standard bolts and nuts in some form or other which gives the information referred to.

[The author is in error in his statement that the depth of the U. S. S. thread is three-fourths of the pitch. It is equal to the pitch $\times$ 0.64952.—EDITOR.]

ARMY ORDNANCE NEWS

Machining Problems Solved in Gun Making—IV

By J. V. HUNTER
Western Editor, *American Machinist*

As gun designers have not held to generally accepted forms of machine design in working out breech mechanisms, the ideas that toolmakers have gained from experience with standard machinery parts need radical revision to conform to these peculiar shapes. The fixtures used in this shop look simple after they are constructed, but all the problems were not easy of solution.

(Part III appeared in our January 15 issue)

THE reader will gain a better knowledge of the production demands for some of the breech mechanism parts of the 4.7-in. rifle, model of 1906, if these are briefly described. The views, Figs. 53 and 54, are therefore given to afford a general idea of the appearance of this portion of a modern gun mechanism when the breech is respectively open and closed. Fig. 53 shows the operating lever *A* which closes the breech when swung to the left. After the block carrier *B* has been closed against the breech face of the gun, a trip block is released which permits the operating lever to swing still further to the left. As it does so, the pinion *C* on the inner end of the lever works on a bevel sector on the rear of the breech block *D* and causes it to revolve one-eighth of a turn until the interrupted threads are completely locked in those of the gun breech. While the gun stands open, the loading tray *E* lies on the breech threads for protection against bruising, but when the breech is closed the key *F* is tripped and the loading tray revolves with the breech block and occupies a space in the sectors.

The lanyard end of the trigger shaft is shown at *A*, Fig. 54, and the shaft itself extends up through the firing-mechanism housing *B*. The outer end of the shell-case extractor *C* is pivoted so that it knocks out the shell case when the breech has been swung far enough open to bring the lug *D* in contact with the outer end of the extractor, thus causing it to swing on its pivot. A more complete view of the breech mechanism is shown in Fig. 55, and this is supplemented by Fig. 56, which shows the block carrier at the right and the breech block at the left. The bevel sector by which the latter is rotated by the operating lever appears at the bottom.

The other main parts contained in the breech mechanism are shown in Fig. 57. Two sides of the operating lever *A* are shown, and as this is shaped from a solid forging, the great amount of work required for its completion can be imagined. The loading tray *B* shows the convex surface which lies next to the gun body; next to this is the trigger shaft *C*; the hinge pin *D* connects the block carrier to the gun body. Other

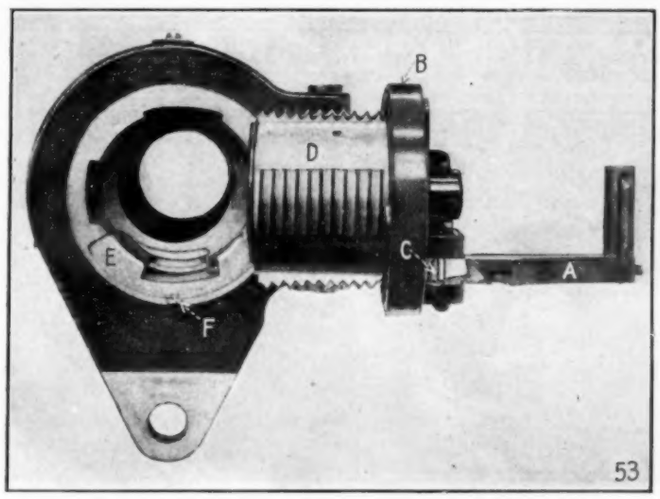


FIG. 53. VIEW OF OPEN BREECH OF GUN

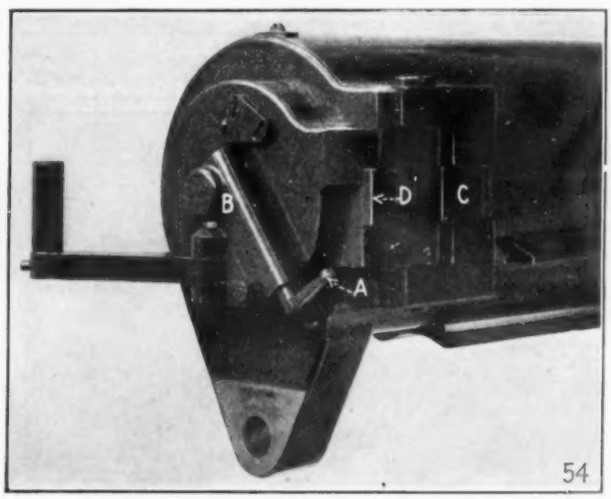


FIG. 54. GUN WITH BREECH CLOSED AND LOCKED

ARMY ORDNANCE NEWS

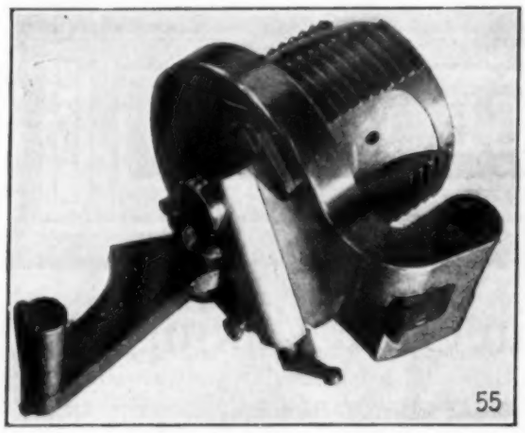


FIG. 55. BREECH BLOCK AND MECHANISM

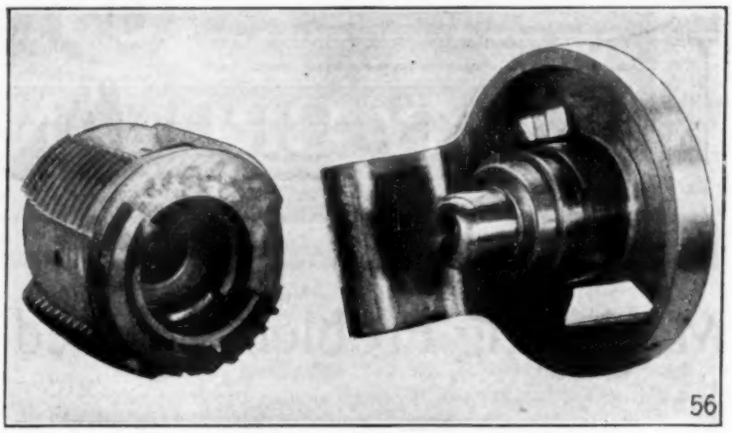


FIG. 56. BREECH BLOCK AND BLOCK CARRIER

parts are the extractor *E*, which shows its pivot trunnions; the lever catch *F*, which locks the operating lever, and the firing lock case *G*.

The small parts used in the mechanism are all included in Fig. 58. Among them *A* is the vent bushing; *B*, the lever-catch pivot; *C*, the lever catch; *D*, the block latch; *E*, the firing pin; *F*, the operating-lever pivot; *G*, the pallet; *H*, the block-stop support; *I*, the lever-catch screw; *J*, the tray latch; and *L*, the firing-pin spring. Some of the other parts shown are, *M*, the firing pin sleeve; *N*, the trigger fork; and numerous small springs and screws used in the assembly.

The locking hoop comes to the shops of the Northwestern Ordnance Co. as a roughly machined forging, Fig. 59, and the early operations on this part are to fit it for shrinking on the gun body. These operations

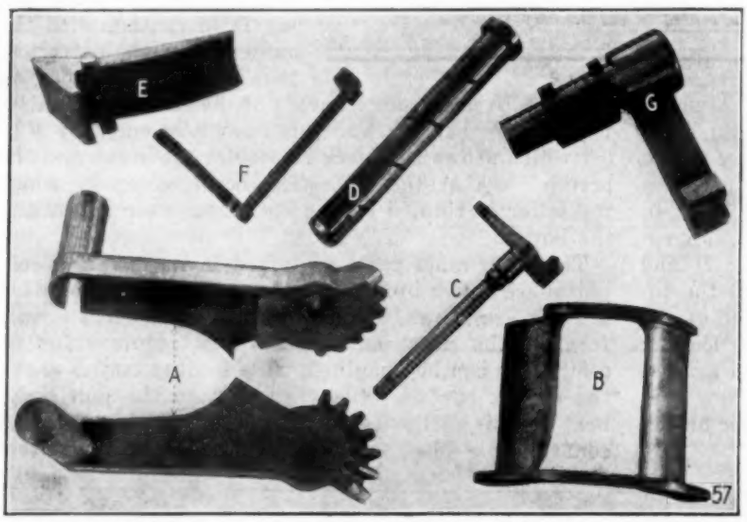


FIG. 57. OPERATING LEVER, LOADING TRAY, FIRING LOCK CASE AND LARGER PARTS OF MECHANISM

FIG. 58. SMALLER PARTS OF BREECH MECHANISM

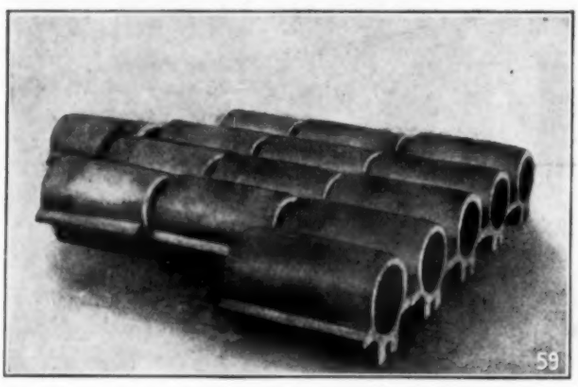


FIG. 59. THE ROUGHLY MACHINED LOCKING-HOOP FORGINGS

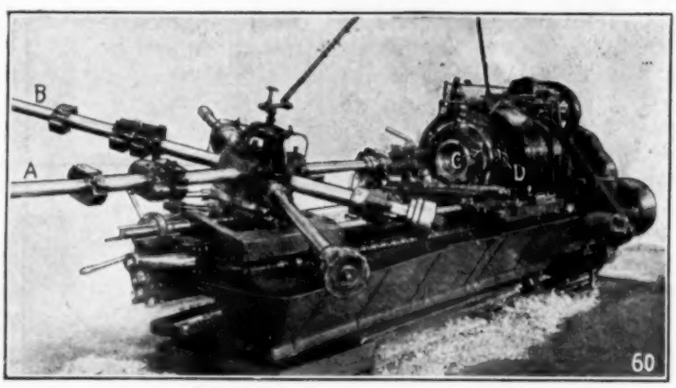
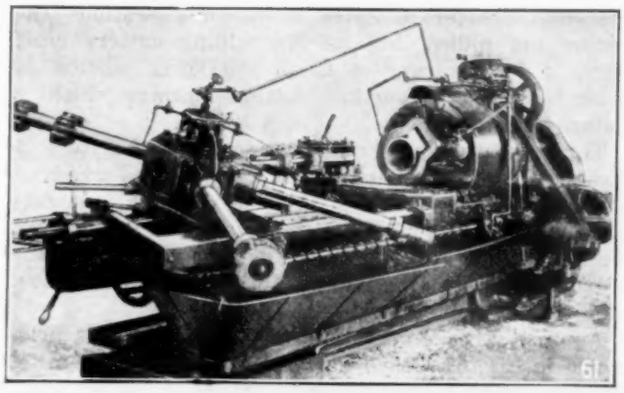


FIG. 60. GISHOLT TURRET LATHE FOR FINISHING BORE OF LOCKING HOOP

ARMY ORDNANCE NEWS



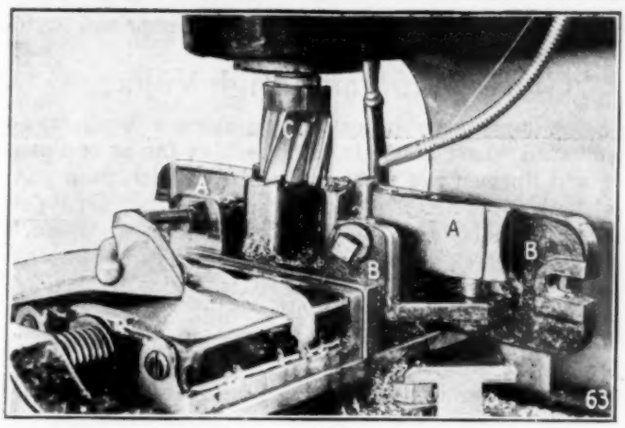


FIG. 61. TURRET LATHE FOR OPERATIONS ON FRONT CLIP. FIG. 63. MILLING SIDE OF EXTRACTOR

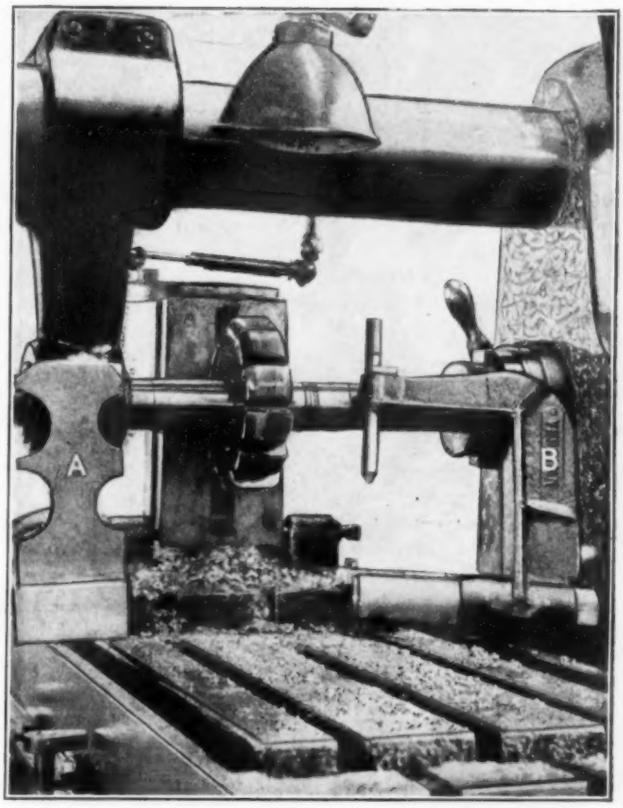
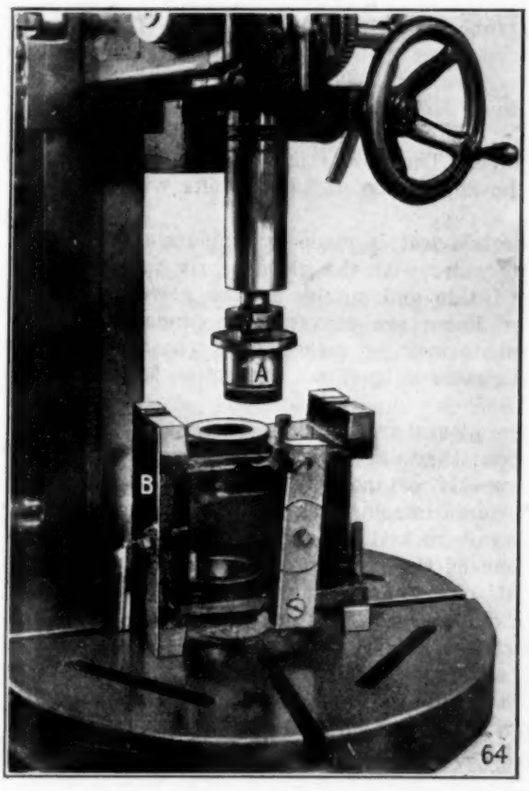


FIG. 62. MILLING GROOVE IN BASE OF FRONT CLIP



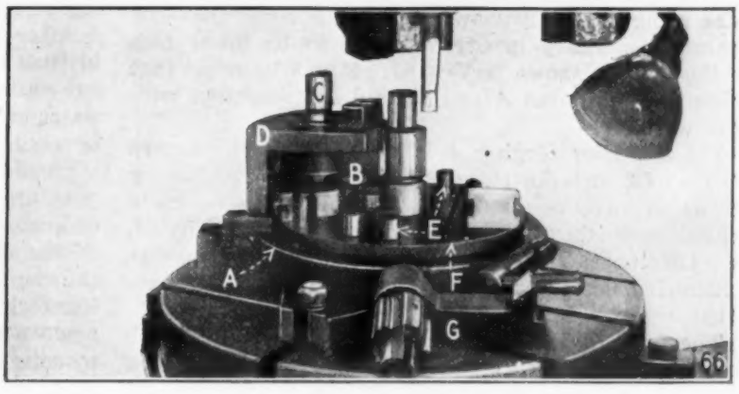


FIG. 64. END MILLING TRUNNIONS ON EXTRACTOR SIDES. FIG. 65. TURRET LATHE SET-UP FOR OPERATIONS ON FIRING LOCK CASE. FIG. 66. INDEXING DEVICE FOR FINISH SLOTTING OF SECTORS OF FIRING LOCK CASE

ARMY ORDNANCE NEWS

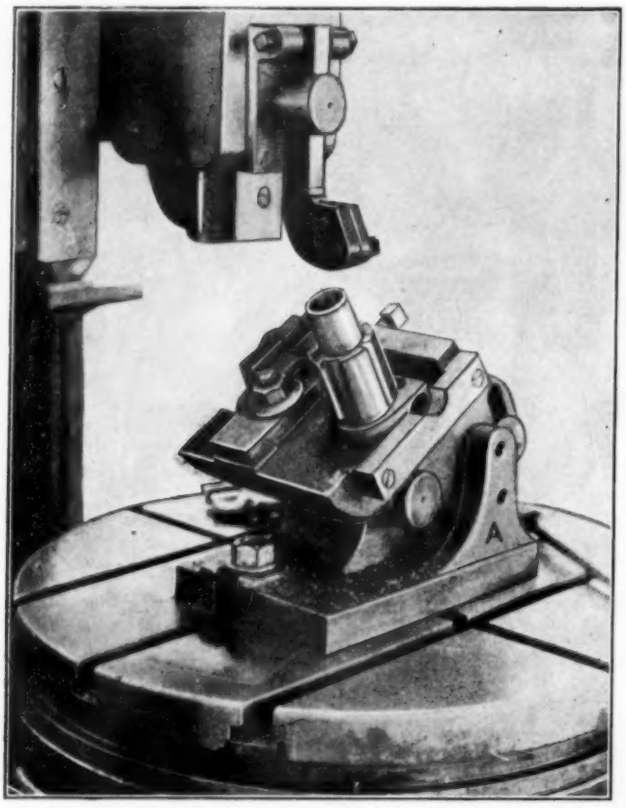


FIG. 67. TILTING FIXTURE FOR HOLDING CASE ON TABLE OF VERTICAL SLOTTER

are completely finished on the Gisholt turret lathe, Fig. 60, which is shown with the complete set of boring bars and tools set up in its turret. Even the very accurate flat thread by which this part is held to the gun body is produced in this setting and is cut by the two tools *A* and *B*. This forging is approximately 20 in. long and it is necessary to hold it in the special pot-chuck *C*, which runs in the cat-head ring *D*. After this part has been shrunk on the gun body, the machining operations to finish it are considered as a part of the machining of the whole gun body.

The Work on the Front Clip Forging

The work on the front clip forging is very similar to that on the locking hoop and is done in a Gisholt turret lathe using the set-up shown in Fig. 61. After the lathe operation, a heavy groove is milled in its lower face in the manner shown in Fig. 62. It will be noted that there are two gages *A* and *B* used in connection with this work.

The extractor forging *A* is held in a special fixture *B*, Fig. 63, and the sides finished to the trunnion by means of an end-mill *C*. A later operation on these trunnions finishes them with the hollow-mill *A*, Fig. 64, in a Cincinnati-Bickford drilling machine. The box-like fixture *B* holds the extractor forging during this operation.

The firing lock case, which comes as a heavy rough forging, is machined on its face, turned and bored on the Gisholt turret lathe. Fig. 65 shows the complete set-up of tools used in the turret for completing this operation. After a series of minor operations the sectors are milled, but as the milling cutters must clear, it is necessary to finish the lower portion of these sectors on a vertical slotting machine which is shown in Fig. 66.

This operation uses an indexing type of fixture *A* which holds the piece partly in a recess and which is clamped down by the piece *B*. The indexing is accomplished by a hollow pin *C* which passes down through the bracket *D* and slips over the studs *E* in the top surface of the plate *F*. One of the finished parts is shown lying on the machine table at *G*.

Another slotting operation on the same part is illustrated in Fig. 67, which shows the method of mounting the forging in a special tilting fixture *A*, so arranged that it can be set at the several angles required.

Gloves Withstand High Voltage

Some day when you are walking along a "main-traveled" road where traffic is piled back as far as one can see and linemen are repairing a broken wire, stop and watch them work. The gloves they wear tell a unique story. Probably the line they are handling is "alive," and carrying electric current enough to cause instant death; yet they pick it up, twist it, splice it as nonchalantly as though handling fishing tackle. They are able to pick up the live wire because of the rubber gloves they wear.

Did you know that these gloves are today made according to rigid specifications completely standardized and that no purchasing agent dare buy rubber gloves until he has thoroughly tested them? No glove can be marked with the manufacturer's name or with the size in such a manner as to injure it in any way. The gloves must each be more than 14 in. long and the average thickness not less than 0.06 in. They must have a tensile strength of 1,200 lb. per square inch and bear having 2 in. of their surface stretched to 12 in. without a rupture. The gloves must be capable of withstanding the application of 18,000 volts without puncturing.

The dielectric test is made by immersing the glove in a pan of water with the glove nearly full of water. The water inside and outside of the glove forms the electrodes. These are conveniently connected to the testing transformer by means of a chain suspended within the glove and by direct connection to the retaining vessel.

After the gloves are purchased, rigid inspection is insisted upon; they are subjected to periodic high-voltage tests weekly or monthly, cleaned with soap and water and stored in cold, dark places. They are marked by serial numbers and their history kept.

Should one of the linemen you have been watching, puncture his gloves, death may result. The perfection of linemen's rubber gloves is one of the silent romances of the electrical industry. They are as important in the day's work as the steel helmet in battle. Today linework is a hundred times safer than formerly, for now when a line is deadened the switch is usually of the modern safety-inclosed type and no other person but the man on the line holds the key that locks the disconnected switch.

Quantity Production of ABC Washing Machines

By J. H. VINCENT

This article is descriptive of a modern plant that is devoted solely to the production of labor-saving machines for household use. Some of the methods of production, together with many of the jigs and fixtures used, are illustrated and described.

ONE of the manufacturing industries which has made very rapid strides during the past two years has been built up about the production of labor-saving machinery for household use.

The Altorfer Brothers Co., Peoria, Ill., manufacturer of washing machines, has recently occupied a large new factory. This factory is remarkable for the excellence of the lighting facilities afforded, which the reader may judge from the fact that nearly all of the views used in the illustration of this article were taken on a cloudy day; sometimes while rain was falling outside,

FIG. 1. FACING OFF HUB OF BEVEL GEAR

and even then with unusually short exposure for interior work.

Most of the material to be used in the construction of the machines is received at the farther end of the shop, where it is sorted, counted, inspected and stored in bins. Some of the castings require grinding in addition to that received at the foundry, and this work is taken care of by a convenient grinding department.

To some extent possibly the rapid machining of parts is due to the simplicity of many of the fixtures which are used. As an example, take the bevel gear for the wringer drive, Fig. 1, which at a previous operation has had its hole drilled. In the operation shown a matrix jig is used for holding it while the hub is being faced. A similar method was used in jigging this when the hole was drilled.

The parts of the machines are designed with a view to keeping the machining operations at a minimum, which proves a great aid in the reduction of manufacturing cost, and the consequence is that the majority of the operations are handled on drilling machines. Single-spindle drilling machines are used in most instances and with these are used jigs which have been designed for permitting rapid placing and removal of the work.

Another simple jig for holding a cast gear blank while its hub is being drilled and reamed is shown in Fig. 2. This utilizes a three-jaw chuck, the jaws *A* of which have a small movement controlled by a cam and operated by the hand lever *B* at the right.

More complicated castings require box jigs such as shown in Fig. 3, the work *A* being the base of the gear reduction box. Pulling out one of the pins *B* releases the clamp *C* so that it may swing down pivoting on the other pin *D*, enabling the work to be inserted or removed. When in position the work is clamped by the screw *E*. Two holes are to be drilled, as will be noted, and angle irons *F* have been clamped to the table of the drilling machine so that the jig may be slid back and forth to bring either one of the bushings under the drill. Another box jig, Fig. 4, for holding a casting of irregular outline is handled in the manner similar to that just described.

Gang drilling machines are used where it is possible for the operator to take care of more than one spindle at a time, one of which is shown in Fig. 5, drilling connecting-rods. Three-lip drills are used, together with a very simple form of jig. A gang drilling machine, Fig. 6, is shown using hollow mills for machining the bosess on the end frames of washing machines.

Other Machining Operations

As has been pointed out, the drilling operations make up the majority of the work and the lathe operations are in the minority. One of the lathe operations, Fig. 7, boring a large bearing hole in a bracket, shows the box form of fixture for holding the work, while the boring bar and finishing reamer are shown on the revolving turret. Cut gears are used in the majority of cases for the reduction and transmission of power through the machine.

One of the operations is in connection with the segment used for the reversing motion on the barrel in the interior of the washing machine. This segment is less than one-quarter of a circle and the periphery and sides are finished by milling in the machine shown in Fig. 8. In holding this casting its hub is slipped over an arbor *A*, while, at the same time, a finished lug *B*

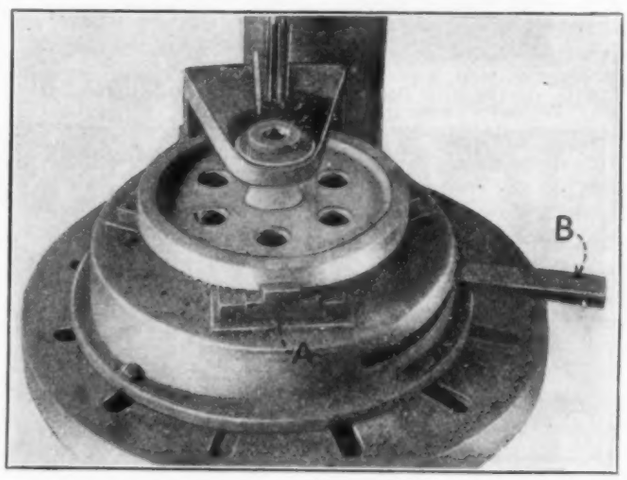


FIG. 2. JIG FOR CENTERING GEAR WHEEL

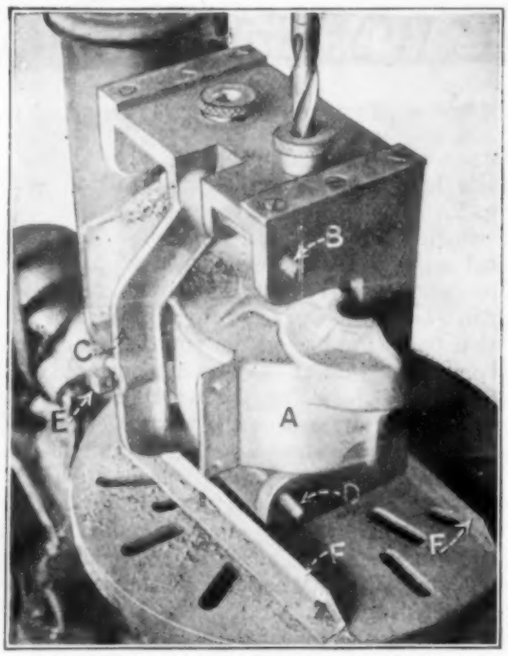


FIG. 3. DRILLING MAIN GEAR CASE

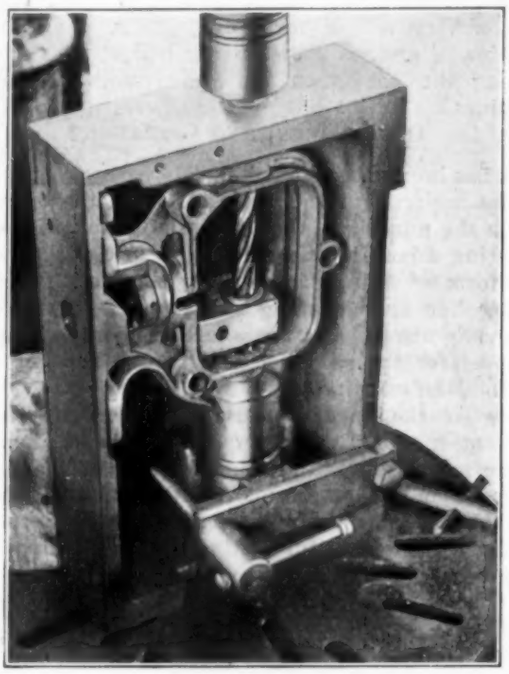


FIG. 4. JIG FOR DRILLING WRINGER-GEAR HOUSING

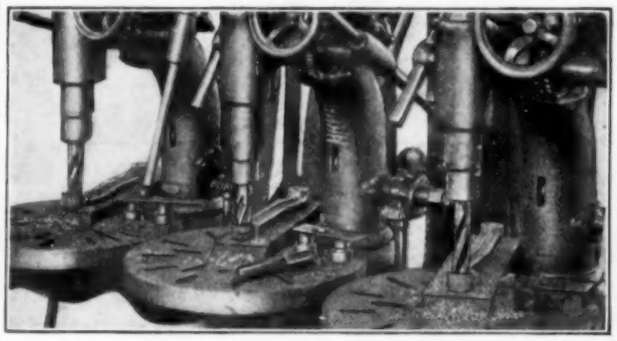


FIG. 5. FINISHING HOLES IN CONNECTING-RODS

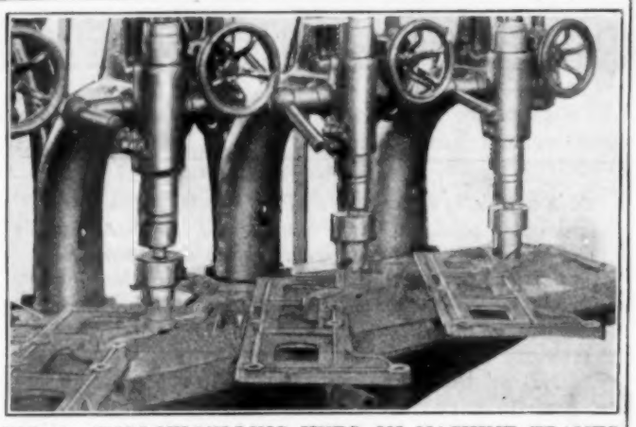


FIG. 6. HOLLOW-MILLING HUBS ON MACHINE FRAMES

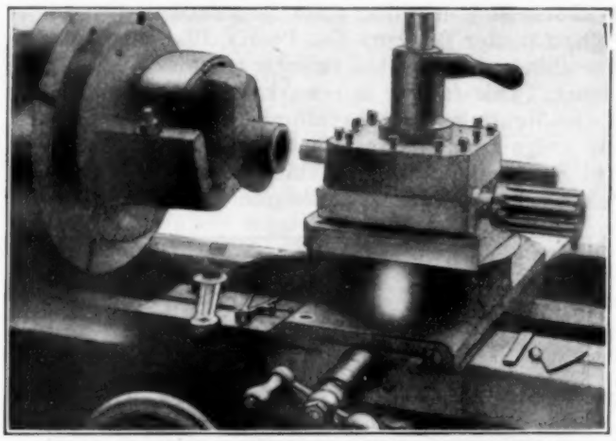


FIG. 7. SIMPLE TURRET LATHE OPERATION

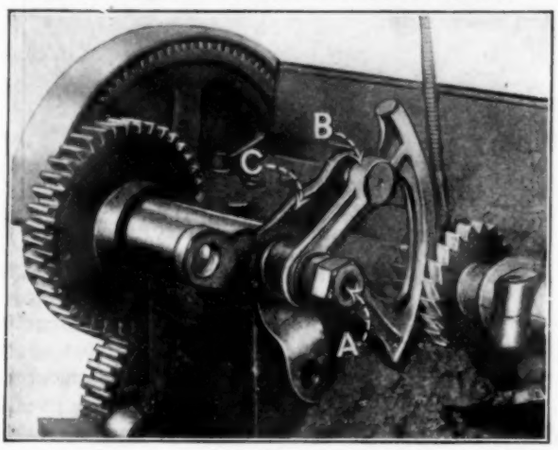


FIG. 8. FINISHING OUTSIDE OF ROCKER-ARM GEAR

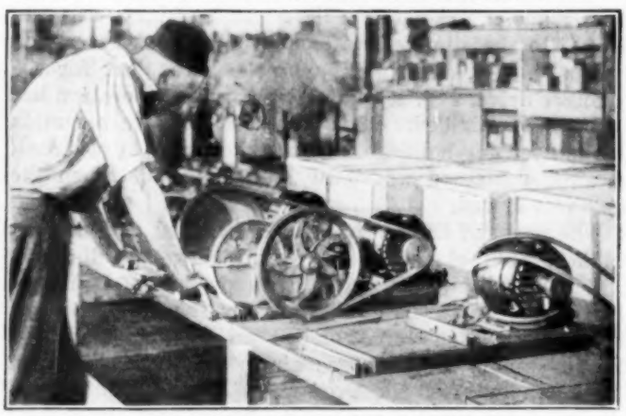


FIG. 10. TESTING GEAR-REDUCTION UNITS

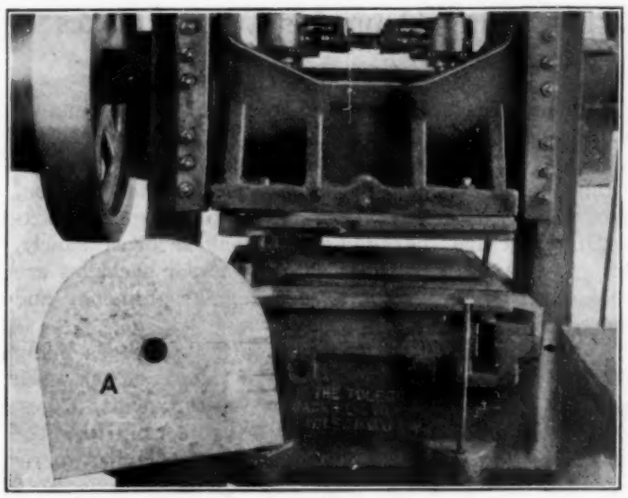


FIG. 9. MACHINE FOR BLANKING AND FLANGING TUB ENDS

on one of its arms slips into a hole which is provided in the three-arm spider *C*.

The frames used for the construction of the washing machines consist almost entirely of sheet-metal sections which are riveted together. The punching of these sections in quantity is done by a Williams & White multiple punching machine. The sheet-metal work is also handled under heavy presses and the Toledo press, shown in Fig. 9, is set up with the necessary combination die for blanking and drawing the flange on the ends *A* of the tubs.

Assembling Operations

The assembly of all small units is completed before they pass along to the main assembly station, and such units as the gear-reduction device shown in Fig. 10 are assembled complete and given a test for smooth and quiet running before they progress beyond this portion of the plant. Each of the testing stations is provided with a small power motor of the same size and type as that used on the washing machine. The tester, as he receives each completed gear box, clamps it in one of the holding fixtures which may be noted along the edge of the testing table and subjects it to several minutes' running while he examines it thoroughly for any defects of workmanship or assembly.

The assembling and riveting of the machine frames constitute another assembly unit, the sections being riveted in part by means of a punching machine.

Some of the assembling operations are carried on in several lines running lengthwise of the shops, and one of these is shown in Fig. 11. The assembly track carries the work about 20 in. off of the floor so that the workman is not compelled to stoop over in placing any of the parts.

The organization of this assembly has really made this a sort of two-unit affair because the bench seen at the left of the illustration is lined by workers, each of whom is engaged in assembling some unit part. As fast as these are completed they are placed in bins beneath each section of the bench or on the floor underneath the main assembly track. At the same time the worker who is placing this part on the machine has his station directly opposite so that there is no transportation required along the length of the assembling floor.

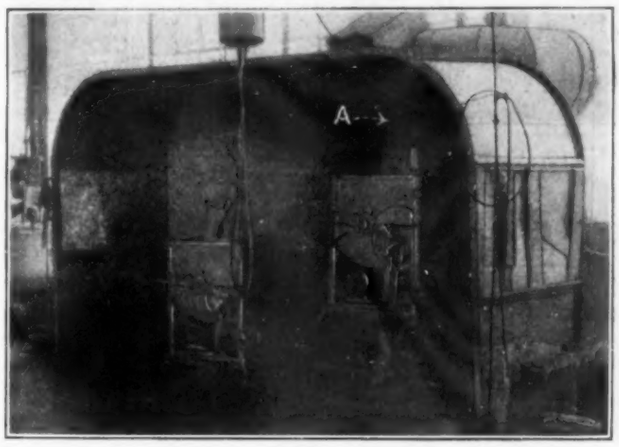


FIG. 12. PAINTING HOOD FOR METAL-TUB MACHINES

The assembly of the metal-tub-type washing machine is completed before painting. It is then taken to the painting hood, shown in Fig. 12, where it is pushed onto platforms which can be raised at the will of the operator by means of pneumatic hoists so that he can readily get at the bottom and all sides of the machine. The piston of this pneumatic hoist permits the machine to be revolved at will as each side is finished. The reader will note that the wringer mounted on the bracket above the machine at *A* is carefully covered by means of a heavy cloth hood to prevent its being marked up by the paint, which is sprayed on by means of an air-brush.

All of the actual painting is performed by one man, who keeps two helpers busy

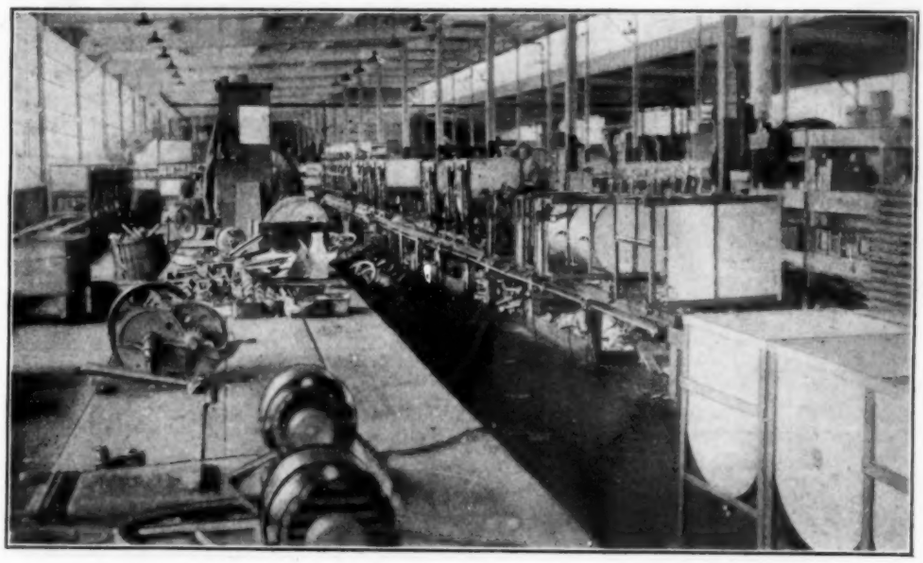


FIG. 11. WASHING-MACHINE ASSEMBLY BY PROGRESSIVE STAGES

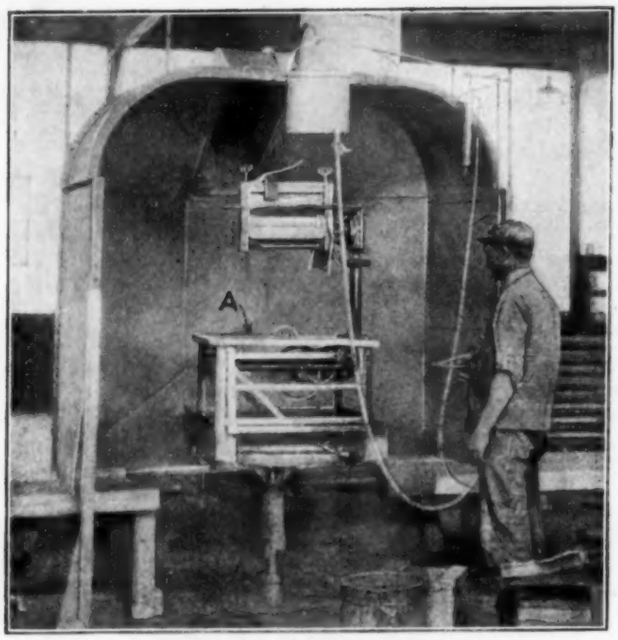


FIG. 13. PAINT-SPRAYING HOOD BUILT ACROSS ASSEMBLY TRACK

in pushing the machines onto the lifting platforms, covering the rollers, and removing the finished machines as fast as they are painted. The large exhaust pipe, exhausting directly into the open air, is provided with a motor-driven fan.

One type of machine is provided with a wooden tub, and as it proceeds through assembly it reaches the point where a paint-spraying hood, Fig. 13, has been built over the assembly track. The painter opens a swinging door at the right and pushes an assembly frame onto a pneumatic lifting platform, then raises it to the required height for spraying on the aluminum finish.

Wood Base Not Painted

The natural-finished wood base is covered with a sheet-metal cover plate *A* which prevents it from being damaged by the paint spray. Upon completion of his work, the painter opens a door at the left and pushes the frame out again onto the assembly track to pass on the concluding operations.

The final assembly on this type of washer is shown as it passes down the track, Fig. 14. After completion of assembly and inspection the machine slides down the sloping track, in the near foreground, so that it reaches the floor level without the necessity of any lifting on the part of the workmen. It then goes to the inspection department where it is run under power for a certain period of time to insure that all parts are in good working order.

Revolving Drum for Testing Boxes

By George F. Paul

To help trim down the national annual loss, estimated at $200,000,000, which might be saved by more perfect methods of packing and boxing, the Government has established the Forest Products laboratory at Madison, Wisconsin. Here has been developed a special box-testing machine, hexagon-sided, that revolves slowly, being run by an electric motor. Whatever packages are to be tested are packed as for regular shipment and placed in this drum.

Devices within this drum cause the packages being tested to follow a regular cycle of drops. Thus, each package drops on its sides, on its top, ends, edges, corners and falls flatwise on a projection like the corner of another box. These drops are planned to reproduce the customary hazards of transportation. A compression-on-edge test is made to simulate the heavy static pressure to which a box is subjected when it stands in the lower tiers of a pile; a steady and constantly increasing pressure, measured in pounds, is applied along any edge, the opposite edge being diagonally through the box in a direct line with the pressure.

In making the revolving drum tests the observer makes note of when and where the container began to weaken and records how that weakness develops until the contents cannot be held. These tests show, for instance, the various causes of nail failure, such as too few nails, nails too short, nails too light, nails too heavy, nails with heads too large or too small. The tests show whether the material in the sides, top or bottom is too thin or not. If it is too thin, the shocks of the drops will pull the wood from the nails, or the wood may split or break across the grain.

Through a study of the various kinds of woods under changing conditions boxes can be built that are practically free from all objectionable features, combining strength, lightness and durability. The studies being made at Madison combine practical experience, which is a knowledge of what lumber is available, and of box factory practice, with accurate scientific tests made on the package itself, packed as in actual service and subjected to strains that approximate actual conditions.

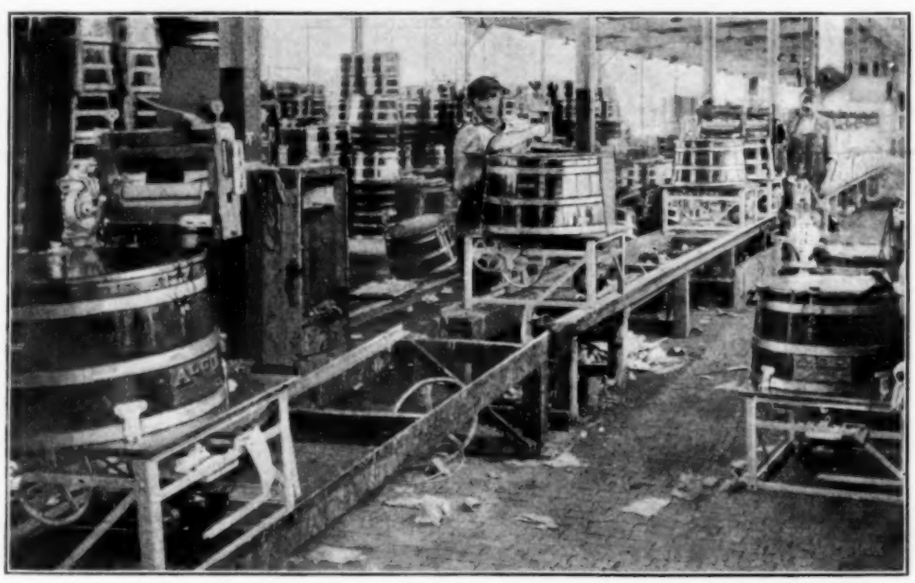
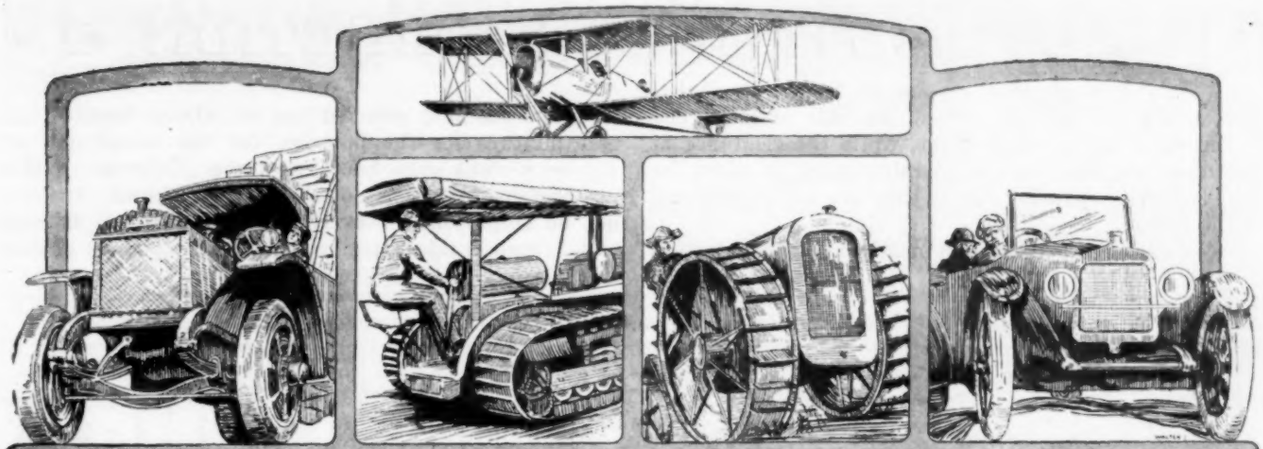


FIG. 14. FINISHING ASSEMBLY OF WOOD-TUB MACHINES



General Data on Automobile Motors

By FRED H. COLVIN
Editor, *American Machinist*

THE facts that have been condensed into the accompanying tables show the trend of motor design and of manufacturing practice as represented by over 20 builders. They show the tendency toward higher-speed motors in passenger cars, nearly all in this series now using over 2000 r.p.m. as a maximum, with a few builders going to or over the 3000-r.p.m. mark as shown in Table I. This table also shows the prevalence of the use of two valves per cylinder, only one of the motors listed using four. There are, however, a few other motors using four valves and one at least which uses three—one inlet and two exhaust valves. Valve diameter varies considerably, the larger valves not always being in the high-speed motors as we might expect. Valve lift is fairly uniform, $\frac{5}{16}$ in. being the prevailing amount almost regardless of diameter.

The Cutting Speeds and Feeds

The cutting speeds and feeds used in cylinder boring are of special interest. They vary greatly as can be seen. The same is true of the amount left for finish-reaming or grinding, where 0.010 in. may be said to be the average. In some cases, however, the amount is much less than this, while in a few instances it is five and even six times as much.

Tolerances do not vary so widely but piston clearances in cylinders run from 0.001 to 0.013 in. Part of this variation doubtless depends on where the piston diam-

TABLE I. CYLINDERS FOR PASSENGER AND TRUCK MOTORS

Maker	General Data: No. Cylinders	R.P.M.	Hp.	Bore	Stroke	Casting	Valves: Per Cylinder	Diam. Inlet	Diam. Exh.	Lift Inlet	Lift Exh.	Machining: How Bored	Cutting Speed, Ft.p.M.	Feed per Rev.	How Finished	Finish Dimensions: Allow for Finish	Tolerance	Piston Clearance in Bore
Autocar	2	2000	18	4	4½	Singly	2	2	2	5/16	5/16	Hor.	88-R	0.013	Ground	0.010	.....	0.004
Chalmers	6	....	45	3½	4½	Block	2	1½	1½	5/16	5/16	Hor.	129-F	0.015	Ground	0.005	±0.0005	0.005
Chevrolet	4	....	.	3 7/16	4	Block	2	1 7/16	1 7/16	23/64	23/64	Vert.	57	0.034	Reamed	0.015	0.002	0.003
Continental	4	2000	34	3¾	5	Block	2	1 23/64	1 23/64	0.3075	0.370	Vert.	.....	.....	Ground	0.010	+0.002 −0.000	0.005
Continental	4	1500	40	4½	5½	Pairs	2	1 31/64	1 31/64	0.294	0.306	Vert.	.....	.....	Ground	0.010	+0.002 −0.000	0.005
Continental	4	1500	45	4½	5½	Pairs	2	2 1/64	2 1/64	0.3045	0.367	Vert.	.....	.....	Ground	0.010	Fitted	0.003
Continental	6	....	..	3½	4½	Block	2	1½	1½	5/16	5/16	Vert.	.....	.....	Ground	0.010	+0.002 −0.000	0.001 0.005
Continental	6	2000	55	3½	5½	Block	2	1½	1½	0.3055	0.337	Vert.	.....	.....	Ground	0.010	+0.002 −0.000	0.001 0.005
Dodge	4	2600	24	3⅞	4½	Block	2	...	...	0.312	0.312	Vert.	.....	.....	Ground	0.010	.....	0.003
Falls	6	2400	23	3½	4½	Block	2	1½	1½	5/16	5/16	Vert.	90	....	Ground	0.005	0.001	0.003–4
Franklin	6	....	25	3½	4	Singles	2	1 7/16	1 7/16	23/64	23/64	Vert.	32	0.015	Ground	0.018	0.001	0.003
Hudson	6	2800	76	3½	5	Block	2	1 13/32	1 13/32	5/16	5/16	Vert.	45	0.062	Ground	0.005	+0.001 −0.000	0.0035
Hupmobile	4	3000	..	3½	5½	Block	2	1½	1½	0.3155	0.3155	Vert.	40	0.055	Ground	0.008	−0.001	0.0025
Kelley-Sp'gf'ld	4	1400	30	3½	5½	Block	2	1 1/16	1 1/16	5/16	5/16	Vert.	.....	.....	Ground	0.010	0.001	0.003
Kelley-Sp'gf'ld	4	1400	40	4½	6½	Pairs	2	2½	2½	7/16	7/16	Vert.	.....	.....	Ground	0.010	0.001	0.003
Light Mfg. Co.	4	2400	31	3¼	4½	Block	2	1⅜	1⅜	5/16	5/16	Hor.	50	0.018	Lapped	0.0015	+0.001	0.003
Locomobile	6	....	..	4½	6	Pairs	2	2½	2½	5/16	5/16	Vert.	.....	.....	Ground	0.012	.....	0.0025 0.003
Lycoming	4	2000	35	3½	5	Block	2	1½	1½	11/32	11/32	Vert.	50	0.031	Ground	0.012	0.0015	0.0025
Maxwell	4	....	..	3½	4½	Block	2	1½	1½	0.197	0.197	Vert.	.....	.....	Ground	0.05	.....	0.013
Mitchell	6	2000	40	3½	5	Block	2	1 7/16	1 7/16	0.2747	0.2747	Vert.	.....	.....	Ground	0.005	±0.001	0.003
Moline-Knight	4	2200	40	3½	5	Block	..	Sleeve valves.				Vert.	50	.....	Ground	0.010	−0.0005	0.010
North American	4	2400	..	4	5½	Block	2	2	2	5/16	5/16	Vert.	.....	.....	Reamed	0.020	±0.001	0.004
Oakland	6	3400	44	2 13/16	4½	Block	2	1½	1½	5/16	5/16	Vert.	50	0.04	Reamed	0.0625	±0.001	0.005
Oldsmobile	8	2600	56	2¾	4½	Block of 4	2	1½	1½	5/16	5/16	Vert.	.....	.....	Reamed	0.040	±0.001	0.005
Packard	12	....	3	3	5	Block of 6	2	1 11/16	1 11/16	5/16	5/16	.....	80	0.015	Ground	0.012	+0.001	0.001
Pierce-Arrow	6	2500	48	4½	5½	Pairs	4	1½	1½	⅜	⅜	Hor.	30	0.125	Ground	0.018	+0.0005 −0.001	+0.003 −0.002
Pittsburg	4	1800	20	3	4½	Block	2	1½	1½	⅜	⅜	Vert.	35	0.003	Reamed	0.008	+0.001	0.003
Premier	6	2400	27	3½	5½	Block	2	1 11/16	1 11/16	5/16	5/16	Vert.	Sleeve 75 Block 98	0.011 0.156	Ground	0.012	0.001	0.005
Rutenber	6	2500	45	3½	5	Block	2	1 7/16	1 7/16	5/16	5/16	Vert.	.....	.....	Ground	0.010	0.001	0.003

AUTOMOTIVE CONSTRUCTION

eter is taken. The clearance at the body or lower end of the skirt can be very slight, while the clearance at the upper end must be considerably more, to allow for the increased expansion due to the heat at the head end of the piston.

Block castings are used in nearly all of the motors listed. A few builders stick to the casting of cylinders in pairs, but the block of four or six is common practice in most shops. The design of two of the motors requires single cylinders. In all the motors but one, the blocks are of cast iron. In this, the Premier, a Lynite block is used with cast-iron sleeves or liners for the cylinder walls proper. While it is generally believed that there is some tendency in this direction, this is the only example in the list.

TABLE II. PISTONS FOR PASSENGER AND TRUCK MOTORS

Maker	Diameter	Tolerance	Clearance	Lgth.	Material	Grooves			Sequence of Operations			Rings		Piston Pin		
						Width	Clearance	Tolerance	Bore	Turn	Drill	No.	Style	Diam.	Height	Held in
Autocar	4.746	0.0005	0.004	4 11/16	C. I.	0.3127	0.0002 0.0012	0.0005	1	2	3	4	Concen.	0.124	4.464	Piston
Chalmers	3 1/4	0.001	0.005	4	Lignite	5/16	.....	0.001	1	2	3	3	Conc.	11/32	7/16	Piston
Chevrolet	3.686	0.002	.....	3 1/2	C. I.	0.189	0.001 0.003	0.0005	1	3	2	3	Eccen.	0.85	3 1/16	Rod
Continental	3 1/2	0.002	0.001 0.005	4 1/16	C. I.	3/16	0.017	0.0002	1	2	3	3	Eccen.	1/4	3 1/16	Piston
Continental	3 1/2	0.003	0.002	4 1/2	C. I.	3/16	0.054	0.0005	1	2	3	3	Eccen.	1 1/32	3 1/4	Piston
Continental	3 1/2	0.003	0.002	3 1/2	C. I.	3/16	0.011	0.0005	1	2	3	3	Eccen.	1 1/32	3 1/16	Piston
Continental	4 1/2	0.003	0.002	5	C. I.	3/16	0.031 0.037 0.057	0.0005	1	2	3	3	Eccen.	1 7/32	3 13/16	Piston
Continental	4 1/2	0.003	.....	5 1/2	C. I.	3/16	0.038 0.058	0.0005	1	2	3	3	Eccen.	1 7/16	4 1/2	Piston
Dodge	3 1/2	.....	0.003 0.0025	4 1/2	C. I.	3/16	0.001	.....	3	2	2	3	Eccen.	0.8125	3.656	Piston
Falls	3 1/2	0.001	0.003 0.004	3 1/2	C. I.	7/16	0.001	0.0003	2	1	3	3	Eccen.	1/4	2 13/16	Rod
Franklin	3 1/2	0.001	Taper from 0.003 -0.011	4	Magnalite	0.1895 to 0.1905	.....	0.001	3	1	2	3	Special	1/4	2 1/4	Rod
Hudson	3 1/2	0.002	0.0035	4 1/16	C. I.	0.1885	0.0005 0.001	0.0005	..	..	..	3	.....	1.0927	3.0625	Rod
Hupmobile	3.247 3.248	+0.000 −0.002	0.001	3 7/16	C. I.	0.1870 0.1880	0.0015	±0.0005	..	..	..	..	.....	0.865	2 1/16	Rod
Kelley-Springfield	3.7455 3.7460	0.0005	0.003	5 1/2	C. I.	0.249 0.250	0.002	0.001	..	..	..	3	.....	1.245 1.250	3 1/16	Rod
	4.4965 4.4970	0.0005	0.003	6 1/2	C. I.	0.249 0.250	0.002	0.001	..	..	..	3	.....	1.207 1.213	4	Rod
Light Mfg. & Fdy.	3 1/2	0.001	0.0035	4	C. I.	1/4	0.0005	0.0005	2	3	1	3	.....	1/4	3	Piston
Locomobile	4 1/2	±0.0005	0.015– 0.003	5 1/2	C. I.	1/4	0.0005 0.001	0.001	2	1	3	3	Eccen.	1 1/4	4 1/2	Piston
Lyconing	3 1/2	0.0015	0.004 0.0065	4	C. I.	3/16	0.0005 0.001	0.0005	1	2	3	3	Eccen.	1/4	3 1/2	Piston
Maxwell	3.612 3.622	+0.0005 −0.000	0.013	3 1/2	C. I.	3/16	+0.0005 −0.000	0.0005	..	..	..	..	.....	0.749	3 1/2	Rod
Mitchell	3 1/2	±0.0005	0.0025 0.0035	4	C. I.	3/16	0.001	+0.001 −0.000	..	..	..	..	.....	0.983	2 7/8	Rod
Moline-Knight	3 1/2	0.002	0.009 0.010	4 1/4	Alum.	3/16	0.0005 0.0013	0.001	1	2 and 3	4	3	.....	1.00	3 1/2	Piston
North American	4	.....	.....	4 1/2	C. I.	3/16	0.001	+0.001 −0.000	1	2	3	..	.....	1.00	3 1/2	Rod
Oakland	2 13/16	0.0005	0.005	3 5/16	Alum.	3/16	0.0015	+0.005	1	2	3	..	Eccen.	0.6675 0.6680	2 7/16	Rod
Oldsmobile	2 1/2	0.004 0.005	0.004 0.010	3 1/4	Lynite	0.1885 0.1895	0.001	0.0005	1	2	3	4	.....	0.668	2 1/32	Piston
Packard	2.997 2.998	0.0005	0.002	2 1/4	C. I.	0.18657	0.00075	0.0005	2	1	3	3	Concen.	0.75	2 1/2	Piston
Pierce	4 1/2	+0.0005	0.002 0.003	5.406	C. I.	1/4	0.001	+0.0000 −0.0005	2	1	3	3	Concen.	1 1/2	4	Piston
Pittsburg	3	0.002	0.003	4 1/2	C. I.	3/16	0.002	0.002	1	3	2	3	.....	0.861	2 1/4	Piston
Premier	3 1/2	0.0005	0.016 0.005	4	Lynite	1/4	0.0015	0.0005	2	1 and 3	4	3	.....	0.8593	3 1/16	Piston
Republic	3.4975	±0.001	0.002	3 1/2	C. I.	0.1865 0.1870	0.0015	0.0005	..	..	..	..	Eccen.	1.0625 1.0635	3 1/4	.....
Rutenber	3 1/2	0.001	0.003	3 1/2	C. I.	3/16	0.001	0.0005	3	1	2	3	Concen.	1/2	2 1/2	Piston

The width of the grooves is remarkably uniform, 3/16 in. being almost universal. A clearance of 0.001 in. between the rings and grooves is also fairly common.

Pistons and Piston Pins

Table II shows the piston practice as far as data has been supplied. Cast iron still predominates as a material but the desire for lighter motors and higher speeds seems bound to result in an increased use of aluminum alloys. Increased expansion has introduced new problems and the alloy selected has not always been of the best mixture for the purpose, but the advantages of lighter pistons seem bound to force a solution of this problem even if it has not already been found. It must not be forgotten, however, that some of the English and French builders use extremely light pistons of cast iron, and though the walls seem so thin as to be frail, they are used successfully in some cases.

Machining the Pistons

In machining the piston the boring of the skirt seems to be the first operation in most cases, although quite a number turn the outside as a starting point. Only one on the list bores the hole as the first operation.

The preference for eccentric and concentric rings is about equally divided, the angular joint being by far the most common. As most motor builders use commercial rings instead of making their own, it is not easy to give much detailed information along this line. Quite a ma-

AUTOMOTIVE CONSTRUCTION

jority of the motors have the pin fastened in the piston and have the bearing in the rod. The practice of clamping the pin in the rod and having the bearing in the piston has many advocates, however. The piston-pin diameter varies considerably and apparently without regard as to whether the pin is held in the rod or in the piston.

CONNECTING-RODS

The connecting-rod data are also interesting as shown in Table III. The greatest uniformity occurs in the length of the rods, the center distance being twice the stroke in most cases, with variations in both directions.

The question of proper diameter and lengths of crankpin bearings has evidently reached no recognized solution. A study of these dimensions, and the relation between the two, shows a great variety of ideas on the subject.

Many small rods have the babbitt for the crankpin bearing cast into the rod itself, but rods for larger motors generally use the separate rod bearing or "brass."

This however is quite apt to be of bronze with babbitt lining (or "bronze-backed babbitt—B.B.B." as it is called in the table). Nearly all use liners or shims between the rod and cap, but a few follow airplane-motor practice and bolt the cap and rod metal to metal.

BROACHING

The finish of the rod bearing is usually secured by broaching but information on this subject was not always definite.

The method of fitting bearings is also indefinite in many cases, the usual practice, however, being to "run them in" by using an electric motor to run the engine during this wearing-in process. The hand-scraping of bearings has been practically abandoned by all builders.

TABLE III. CONNECTING-RODS FOR PASSENGER AND TRUCK MOTORS

Maker	Cylinder of Motor Bore	Cylinder of Motor Stroke	Center Length of Rod	Bearings — Piston Pins Diam.	Bearings — Piston Pins Length	Bearings — Crankpin Diam.	Bearings — Crankpin Length	Cast in Rod or Separate	Kind of Metal	How Finished	How Fitted
Autocar	4¼	4½	9	1.121 1.122	2⅞	1.860 1.862	2.478 2.482	Sep.	B.B.B.*	.....	.....
Chalmers	3½	4½	10	⅞	1⅛	2.25	1.5	Cast	Babbitt	Reamed	Run in
Chevrolet	3 1/16	4	7½	0.850	1.00	1.3755	1.875	Cast	Babbitt	.....	.....
Continental	3¼	4½	10½	⅞	1⅛	2½	1 31/32	Sep.	B.B.B.	Reamed	Run in
Continental	3¼	5¼	10½	1 1/32	1⅛	2½	1 13/32	Sep.	B.B.B.	Reamed	Run in
Continental	3¼	5	10½	1 1/32	1⅛	1⅞	2 1/32	Sep.	B.B.B.	Reamed	Run in
Continental	4¼	5½	10½	1 1/32	1⅛	2	2½	Sep.	B.B.B.	Reamed	Run in
Continental	4¼	5½	11	1⅛	2½	2½	3	Sep.	B.B.B.	Reamed	Run in
Dodge	3.875	4½	11.39	0.812	1.750	1.625	2.125	Sep.	B.B.B.	.....	.....
Falls Motor	3½	4½	.....	0.740	0.75	1½	1½	Cast	.....	Reamed	.....
Franklin	3½	4	8	⅞	.....	1⅜	1 13/16	Sep.	Die cast	Broached	.....
Hudson	3½	5	11½	1.093	1.00	2½	1.989	Sep.	Alloy bronze	Reamed	Run in
Hupmobile	3½	5½	11½	0.865	0.875	1½	1½	Sep.	B.B.B.	Broached	.....
Kelley-Springfield	3½	5½	11	1½	1.00	1½	2½	Sep.	Die cast	Reamed	.....
Kelley-Springfield	4½	6½	14	1½	1½	2½	3½	Sep.	Die cast	Reamed	.....
Light Mfg. Co	3½	4½	9	⅞	1½	1½	2	Sep.	Bronze	Broached	.....
Locomobile	4½	6	12	1½	2½	2½	2	Sep.	B.B.B.	Broached	.....
Lycoming	3½	5	9½	⅞	1 7/16	2	2½	Cast	Babbitt	Broached	.....
Maxwell	3½	4½	7½	⅞	.....	1.875	3½	Cast	Babbitt	Broached	.....
Mitchell	3½	5	10½	0.984	1½	2	1½	Cast	Babbitt	Reamed	.....
Moline-Knight	3½	5	10½	1.00	1½	2	2½	Sep.	B.B.B.	Broached	.....
North America	4	5½	11½	1.00	2½	1½	2½	Sep.	Die cast	Reamed	.....
Oakland	2 3/16	4½	9	0.668	1 1/16	1.618	1½	Cast	Babbitt	Reamed	.....
Oldsmobile	2½	4½	9½	0.669	1½	2.124	2.126	Sep.	B.B.B.	Reamed	.....
Packard	3	5	12	⅞	1½	2½	1½	Sep.	B.B.B.	Reamed	.....
Pierce-Arrow	4½	5½	11½	1½	2	2½	2½	Sep.	B.B.B.	Reamed	.....
Premier	3½	5½	11	1.065	1½	2.565	1.764	Sep.	B.B.B.	Reamed	.....
Rutenber	3½	5	9½	⅞	1½	2	1½	Cast	.....	Broached	.....

*B.B.B. means bronze backed babbitt or bearing metal.

Milling and Boring Winton Cylinders

BY I. B. RICH

The fixtures used by the Winton Motor Car Co. in milling and boring cylinders are particularly interesting on account of the way in which they handle work in comparatively small quantity and without undue initial expense. The same type of fixture will be seen in all three of the illustrations and this of itself reduces the cost of making these fixtures which, it will be noted, are of simple and inexpensive design.

Fig. 1 shows the double fixture used in milling the bottoms of the cylinder flanges. These cylinders are cast in pairs and are supported in the front in the fixture on the hard steel pins *A* and *B*, a suitable support being provided at the other end so as to allow them to be equalized at right angles to the cylinder bore. The clamp *C* has an equalized bearing on the upper side of the cylinder, pressure being applied by a substantial screw in the center. The other end of the cylinder is held by a similar clamp *D*. These clamps are loosely connected to the crossbars *E*, these having open ends which latch under the bolt head as at *F*, so that they can readily be swung in or out of contact as may be desired. This construction is shown very clearly at *D*, Fig. 2.

Fig. 2 shows the same type of a fixture arranged for holding the cylinders in a vertical position while the sides are being faced. It will be noted that the cylinders rest on tissue paper at *A* and *B*, the clamps holding the cylinder down as shown in Fig. 1. The blocks *C* position the cylinder sidewise so as to secure the proper distance of the milled surface from the bore. The first illustration shows two fixtures mounted on the table, while in the second, only one cylinder block is shown in position.

The cylinders are rough- and finish-bored at the same

AUTOMOTIVE CONSTRUCTION

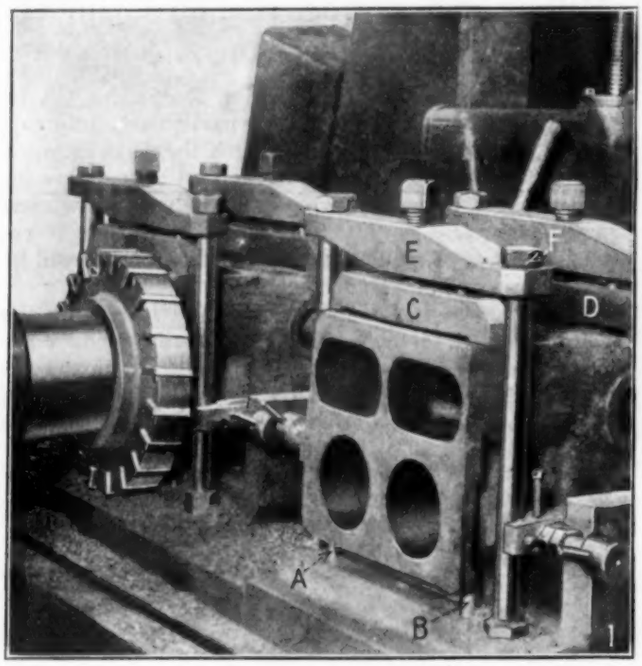


FIG. 1. FIXTURES FOR MILLING CYLINDER BASE

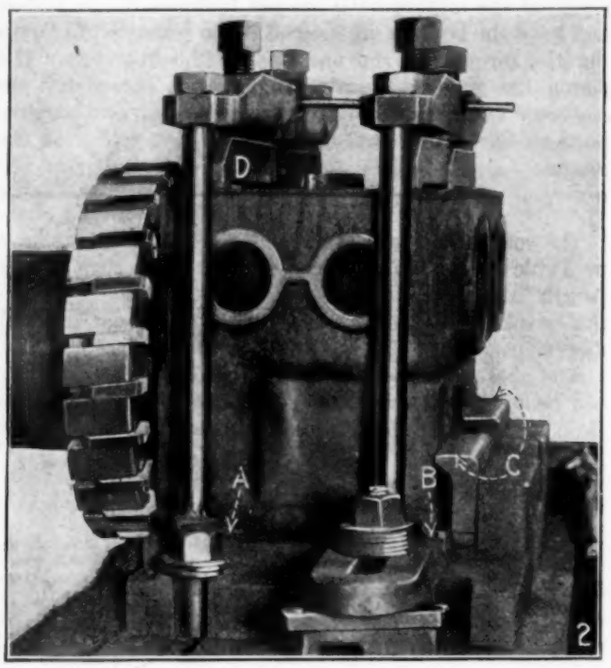


FIG. 2. MILLING THE SIDES OF THE CYLINDER

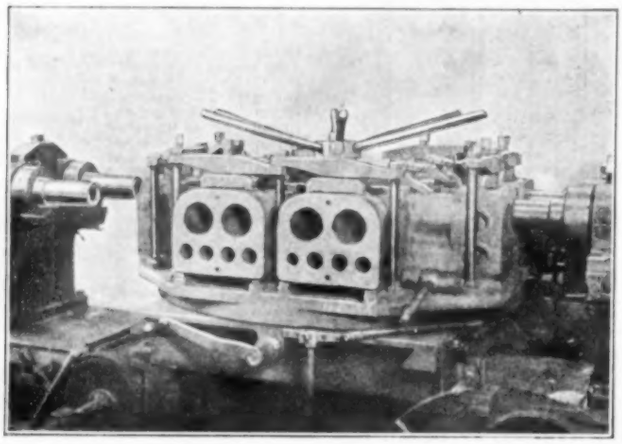


FIG. 3. THE METHOD OF BORING THE CYLINDERS

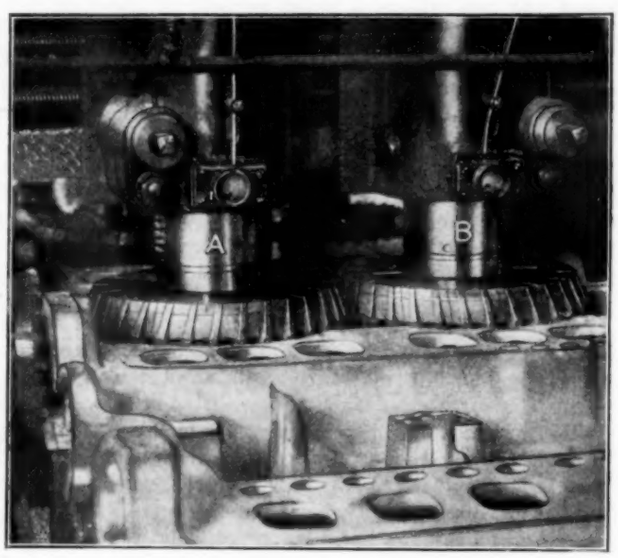
setting in a four-spindle Beaman & Smith machine having the work carried on a turntable as can be seen in Fig. 3. The same type of clamping fixture is used, each of the four sides of the table holding two cylinder blocks. This allows ample time for loading and unloading and makes the work very accessible to the operator. After the table has been indexed it is locked in position by the pilot wheel with angular spokes shown over the cylinders.

Intermeshing Milling Cutters

BY FRANK C. HUDSON

The illustration shows a somewhat unusual arrangement of large milling cutters for surfacing crank cases in the Chandler motor plant. The main spindles, *A* and *B*, are adjusted together so that the teeth of one cutter come in the space between the teeth of the mating cutter. They practically mesh together in the same way as a pair of gears, except that the tooth space is so wide that there is no contact, as this would, of course, be fatal to the cutters.

These cutters finish the surface without a break and have the effect of a single cutter as large as the added diameter of the two. There are also two end cutters, and as the machine is double-headed and has a long table, it handles a large number of crank cases per day. This arrangement requires careful grinding and setting, but seems to be done without difficulty.



MILLING CUTTERS THAT MESH

A Factory Town

By W. OSBORNE

In this article the author draws a picture of the beginning of an industry and follows with a vivid description of its growth to prosperity, the coming of other industries, the birth and development of a town, the advent of the expert, the commencement and results of labor troubles, the dissatisfaction of stockholders, the change of management and all the evils attendant on these things; how the overload spelled disaster and what happened to the industries and the town. The picture is not overdrawn and it behooves us all, employers and employed, to stop—look—listen, "for these be parlous times."

ONCE Zumbar was just a space on the surface of the earth. Having the usual sunlight, water and so forth, some people took it for a place to live in and it evolved into farms.

One of the farmers who had a "knack of tinkering" set up a little shop for his own use. His neighbors soon found that it was easier to take their machinery troubles to this shop than it was for each one to worry with his own. These neighbors furnished any assistance that might be needed.

The community grew and got to the dignity of having a name, and a store, and a church, and a graveyard, and the other appurtenances of a town; and, by and by, it was made a stop on the railroad, and had a post office; and the shop grew and finally got to be a "factory" that had shares of stock to represent the interests of the ones who had put money into it, for it had taken money to keep it growing.

Everybody in the community owned some of the stock.

When things were quiet on the farms the men found work in the factory, and so it was with the other activities of the neighborhood; and when extra help was needed on the farms or in other temporary lines of activity, some of the factory help supplied the need. Thus, the factory served as a sort of reservoir that took in and gave out energy to the benefit of all concerned.

In the beginning the material for use in the factory had been obtained from the surrounding neighborhood, which had also absorbed most of the output; but, as time passed and the factory prospered, there grew a demand for its output from farther away, and as that demand was met it became necessary to ship in material, and to get labor from farther away, and it was also necessary to get more money so as to enlarge the capacity to meet the demands.

The management of this factory had always remained in the hands of the man who had started it, and by this time he had disposed of his farm and other property and put the proceeds into it. He had also put in all of the money that he could borrow, and he was beginning to be spoken of as being a rich man, and the leading citizen of Zumbar.

Time passed. Not a very long time considered by itself, but time enough to bring a large increase in the population of the town, and to bring water works, and electric lights, and picture shows and a board of trade.

The prosperity of the factory and the activities of the board of trade had induced several other factories to locate in the town, and it could boast of two daily papers that seemed to know by instinct that each should oppose whatever the other favored. The instinct of the leaders in social, political and religious lines seemed to tend to the same view of things. Zumbar had all the ear-marks of getting to be a modern and up-to-date American city.

One of the prominent earmarks of the modern city is the expert. Experts began to blossom on all sides. Quietly but efficiently some of these experts began to show the working men that they were slaves who were working for a cruel taskmaster, whose only interest in them was in coining the life blood of themselves and families into dollars. The result was demands, followed by a strike in which, or so it seemed to the manager, the entire community took either active or passive sides against him. The interests, which had been teaching distrust, by the aid of subtle propaganda, etc., of the motives of all of those who did not belong to their own particular party of whatever kind it might be, had done their work well. The strike was finally compromised, not according to any principle of right and justice, but according to the force which could be applied. The merchants were being forced to give credit that filled them with uneasiness, and they called for a settlement—any kind of a settlement that would shift the load from them. The newspapers lived from the advertising of the merchants, and they voiced the demands of the merchants.

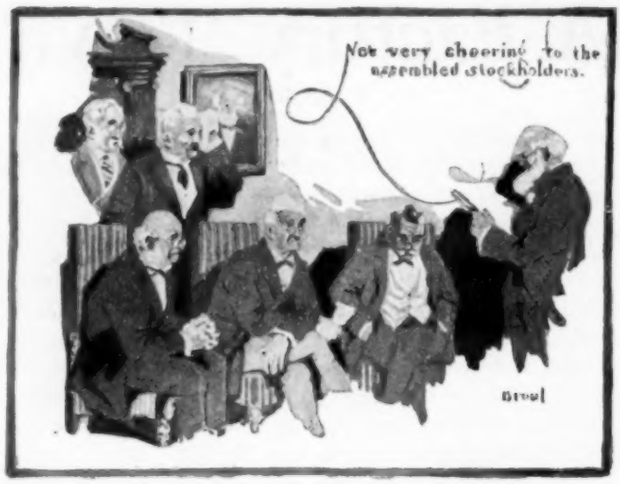
The labor-vote threat was held up to the politicians and they used their power to compel a settlement. The labor expert very adroitly worked on the sympathies and lack of practical experience of the clergy and they, failing to investigate the actual conditions in this (their home town), listened to the tales of the awful conditions which were said to exist in far away cities and which were blamed directly on the fact that some men had been energetic enough to furnish work for some other men, and pressed for a settlement. The directors of the bank saw trouble ahead with money being constantly spent and none being earned, and they urged a settlement.

A settlement was made—a settlement of force—and the labor expert was able to begin the same line of activities with the other employers in the town.

In the mean time other labor experts had been doing things among railway employees, and among the producers of the raw materials which the factory had to use; and both freights and the cost of raw materials

rapidly advanced The freight hit the factory both coming and going. Higher rates had to be paid both on the raw material and on the finished product.

At the annual meeting the manager's statement of the earnings was not very cheering to the assembled stockholders. A number of these who were not practical factory men but who were professional men, and financiers in a small way, had secured the services of a business expert; that is to say, the business expert had sold his services to quite a number of such stockholders, and had convinced them that the business was not being properly managed.



Being fortified by information these stockholders, through one of their number, did not mince matters in showing how much more money might have been made under different management, and the other stockholders were horrified to learn of the amount of money which should have been earned in the past but was not, and moreover, to have the manager draw a gloomy picture of the future.

The manager admitted that he did not know all that there was to know about factory management. This was the only factory that he had ever managed, and all that he knew about factory management had been founded on his experience in managing it. Unfortunately for the other stockholders he now held a majority of the stock. He explained that this did not come from any fault of his but came because, when the factory had been obliged to sell stock to get money to enlarge the capacity, he had always bought any of it that others did not take, and, when any stockholder had wanted to sell his stock and could not find any other buyer, he had bought it.

He further explained that he did not desire to stand in the way of the future of either the other stockholders or of the town, and in view of the fact that he was likely too old to learn the more modern ways he would be willing to sell his stock to any combination of the others who would buy it. He named a price for it that was according to what the annual report had shown would be a fair value.

As a result of this offer a combination of some of the other stockholders bought the manager's stock, and as a concession they let some of the business men who had not before been stockholders have some of it, although at a considerable advance over what it had cost them. This they thought but right, in view of the increased earnings which would come from expert management.

While there was no active demand for this stock some others of the older stockholders sold their holdings to the active interests who were wanting to get in on a good thing.

A new and enlarged board of directors was elected by the stockholders. An up-to-the-minute manager was hired. Efficiency experts made an investigation of every phase of the business. Reports were made.

It surprised the board of directors to find what a poor factory that factory had always been. It surprised them to find out how much it would cost to make a modern factory out of it. It surprised them to find out that as the improvements were made the character of their employees was changing. It surprised them to find that the large returns were always in the future and that before they could be realized more money would have to be spent on more improvements. It surprised them to find out how many different ideas a large board of directors who were without practical experience can have, and how hard each one could insist that his idea be given a trial. It surprised them to receive demands of all kinds from their employees and to have numerous strikes.

Some were for increase in pay. Some were for shorter hours. Some were the result of one lot of workmen claiming the right of controlling another lot of workmen who would not admit that right. Some were because of sympathy for some other lot of workmen in some other factory who were on strike. Some were because of a new expert who had been taken on. Some were because of a popular but inefficient workman who had been discharged.

It surprised them to find out how much such demands cost whether settled with or without strikes.

These were not all of the surprises which they received as time passed.

From the outside things had many of the appearances of prosperity. New buildings had been erected. New machinery had been installed. New methods had been inaugurated. Along with these things a new feeling toward factories had sprung up. Factory laws seemed founded on the idea that factory owners were monsters. Taxes seemed based on the idea that they had an endless amount of money that could, with safety, be drawn for any purpose that might please a number of voters. Notwithstanding the fact that the price of food was going up, because men were leaving the farms where they were their own bosses and going into the factories where they put the

responsibility for results on others while they got a regular wage, the pulpit and the press dwelt on the iniquity of being able to make a success of running a factory. No, they did not word it exactly that way; but analyzed, that was the only meaning that could be arrived at.

Years passed and new managers came and went and it finally became evident to even the most hopeful that the business was not a paying one.

The newest manager was asked for a statement as to why it was not paying, and his report was discouraging but convincing. It was in substance: that, the investment was too large for the amount of business that could be done; that the situation was not right for the amount of business being done either in relation to the supply of raw material, or to the market for the finished product; that the supply of labor was neither of the desirable kind nor in sufficient quantity for the factory's needs; that the town was not the sort of place where labor such as they needed could be induced to come and to stay.

Down the Grade

You have been told before that Zumbar was just a space on the surface of the earth. The railroad that served its needs evidently also had some efficiency experts in its service for it straightened out the road in such a manner that Zumbar was no longer on the main line but was dependent on a loop that gave it one combination passenger and freight train each way a day. This was the finishing stroke. A committee of the stockholders was appointed to get as much out of the business as possible.

The amount that was realized was below the estimate of the most pessimistic. It is wonderful to behold the way values shrink when once a concern quits, and it is wonderful how fast a town can go down once it gets under way. The bank did not fail but it went out of business. Two of the smaller factories moved elsewhere and the sheriff closed up another one.

Anyone who has seen a mining town after the ore is exhausted or a lumber town after the timber is all cut or an oil town after water replaces the oil will know how Zumbar now looks. There is not any natural reason for a town being there and the business reason is gone. The factory is dead.

Is it of any use to hold a post mortem?

A Small Shop's Experience with Cheap Labor

By Elmer W. Leach

I expect every one of my readers has said as many times as I have when remarking on some other fellow's wrong actions or bad judgment, "Well, it has been a costly experience, but he has learned something." However, it is not until one has made a few costly mistakes himself that he realizes the truth in his own casual remarks that "one learns by experience."

Now all of this means that the writer's firm has just completed a costly experiment; that is, the conclusions have been drawn, but we have by no means footed the bill, nor have we reaped the benefits of our deductions.

Ours was an experiment with labor—with cheap labor. To give a bit of personal history, we started our little factory less than a year ago, and not being blessed with an unlimited supply of capital we felt the necessity of exercising caution in our expenditures.

An unpleasant thing about a small shop is that its owners do not always dare go ahead with projects or ideas that really seem to be essential, because they must look ahead to Saturday's payroll, and they realize that it is already large enough to cause concern without making it larger by hiring the most expert machinists at the highest wages.

One of our first errors in judgment was our belief that we were exercising the greatest economy in hiring shop men at the lowest rate obtainable. We did that very thing when we opened our shop; we hired four such men, put them to work and turned out machines. All this was some months ago. None of those original men are with us now. Two of them left us, and two were asked to leave. The first of this year we made a resolution to hire good men at good wages, and I can already show very concretely how it has worked out in actual

practice. Our lowest paid man now is paid 7 cents an hour more than our highest paid man in the old crew.

One of the small machines which we manufacture requires two gears, 2½-in. diameter, ⅝-in. face, and ¾-in. bore. The lathe operations on the blanks were five in number, as listed later on. All of our jobs are figured on a "cost per piece" basis, and a "man hours per hundred" rate.

With the first crew we had been satisfied with the figures given in Table I.

TABLE I. COST OF WORK BY LOW-PRICED LABOR

	Operation	Cost Each	Man Hours per 100
1.	Face, drill, ream	0.0434	9.6
2.	Face second side	0.0309	6.9
3.	Straddle-facing	0.0273	6.1
4.	Rough-turning	0.0481	10.7
5.	Finish to diameter	0.0193	4.3
		0.1690	37.6

A short time ago one of our new men ran through 360 of these gear blanks as his first job. We could see by the way he attended to business that the work was coming right along; but we had not excepted any such shock as we received when the time cards came through on the finished job.

His costs and time rates are shown in Table II.

TABLE II. COST OF WORK BY HIGH-PRICED LABOR

	Operation	Cost Each	Man Hours per 100
1.	Face, drill, ream	0.0240	4.4
2.	Face second side	0.0137	2.5
3.	Straddle facing	0.0172	3.1
4.	Eliminated		
5.	Turn to diameter	0.0184	3.3
		0.0733	13.3

To me there is a world of meaning in these two time studies, and they should be significant to your readers as well; for even though their manufacturing problems may be as far removed from mine as north is from south they surely cannot fail to recognize certain salient points which are applicable to all manufacturing plants.

First, let us see exactly what this new man did (and by the way, his performance was no "beginner's spurt," for he is keeping up the good work on subsequent jobs). Despite the fact that he was paid much more than the first man he reduced the cost per piece $0.0957, or 57 per cent of its original figure—the figure upon which we had based our selling price. Despite the fact that he used the same machines as the first man and worked under the same conditions all around, he increased the production 283 per cent. Also notice that he has eliminated one operation. We used to put ten blanks on a mandrel at a time when we turn them to diameter; and for some reason which we do not yet understand they would come eccentric.

By making a roughing cut and a finishing cut our first man was able to keep the average inaccuracy around 0.005 to 0.006 in. We did not say anything about this point to the new man—just let him go ahead with the job in his own way. The biggest inaccuracy we have found in his work is 0.003 in.; 90 per cent of the blanks do not run over 0.001 in. off.

We have been told at various times that "a little and good is better than a lot and bad," but it certainly seems with shop men that the good ones are the ones who also turn out the most work.

We have two big regrets: One is that we ever bothered with cheap machinists and the other is that this fellow hasn't got a dozen brothers just like himself.

Good machinists—men who can turn out accurate work rapidly—are scarce, but, thank Heaven, there are a few of them left and they not only command but are worth good wages. We have found a very few (as I said, we are only a small shop) men of the same caliber as the one whose time study I have quoted, and we have welcomed them to our shop with open arms. Our payroll is much larger, of course, but its increase in no way approaches the increase in production which has resulted. Machines which we had been content to produce at a rate of a hundred a month are now leaving our factory two hundred and fifty a month.

I am a new man as an executive, having first reached that point on the ladder of life in this present venture of engaging in business for myself, but from my own costly experience with men I have formulated one rule which with me will be ironclad. I would state it something like this: The only way to insure turning out the best work is to hire the best men, give them the best treatment and pay them the best wages.

I haven't the slightest idea what you would do with a man who could increase your production 283 per cent, but I want this man to show the rest of our crew how it is done, and so I told him only last week that just as soon (and I plan that will be within a few months) as we can use a foreman, I want him to hold that position. He is our highest paid man and yet he is our cheapest man—that is what I learned by experience.

What Is a High-Grade Machine?

E. B. WESTON

On page 358 of the *American Machinist* Entropy says, in beginning his discussion of the above question: "A high-grade machine is a good one." I certainly agree with Entropy on this point.

Now I wonder if the readers of *American Machinist* will agree with me when I say a good machine is not always a high-grade machine. Not long ago we received from the manufacturers a certain machine which, after a fair trial, I am ready to say is a good machine but not high grade.

It is a good machine because it is of good design; is not complicated; is accurate, strong and sturdy, and because with a fairly good operator on the business end of it, it will produce the goods. The product of this machine is well within the limits of inspection and the quantity is satisfactory.

The reason why it is not a high-grade machine is because it is not a "well finished" machine. In other words, high-grade workmanship was slighted or rushed through the shop in a hurry on some of the minor details (probably not thought necessary to the operation or accurate production of the machine). Sharp corners were left exposed on gear and wheel hubs, lever bosses, etc. Evidently filler and paint (or painter) was scarce, or perhaps H. C. L. or H. C. P. had something to do with it.

The workmanship was good where it really had to be, but some of the levers, handwheels, etc., were surely assembled in a hurry, having loose fits on shafts with loose feathers, keys, etc. There were not enough of these faults to prevent good operation of the machine with a good production, but there were enough to prevent one from calling it "a high-grade machine."

To be brief, it is my opinion a high-grade machine must be what this machine is and also what it is not.

Machining Monel-Metal Carbureter Float Points

By W. H. Addis

Monel metal which is 71 per cent copper, 28.8 per cent zinc, and 0.2 per cent lead, offers a very difficult machining problem when it is used for carbureter float points. The copper content causes the metal to tear when a box or forming tool is used. The metal is rolled to triangular shape ¼ in. across the sides. The points are cut about ¾ in. long over all, and have a point formed at an angle of 60 deg. to the center line. This point must be gasoline-tight when lightly seated. It is not practical to grind these as the metal is so soft that it quickly becomes charged with the abrasive and forms a first-class lap.

The Van Briggle Carbureter Co., Indianapolis, has overcome the many difficulties which this job presents by using the set-up shown in Fig. 1 *A* being the turning tool and *B* the formed cut-off and point-roughing tool. The triangular-shaped monel-metal bars are chucked and turned to size by the turning tool. The turret is then indexed to bring the point-finishing tool into position as shown in Fig. 2. This tool is a very neatly constructed piece of work. It carries a bronze housing *A* set at 60 deg. to the center line, which serves to hold and guide the tool bar *B*. This bar carries a rack which meshes with a pinion on the under side of the wormwheel *C*. The tool bar is given a very fine feed by turning the handwheel *D*. The cutter used at *E* is of the conventional diamond-point shape, and when carefully fed, leaves the points with a fine finish which is gasoline tight when seated.

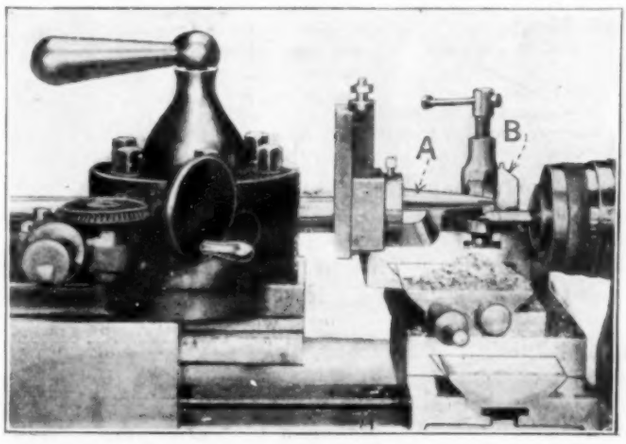


FIG. 1. SET-UP FOR MACHINING MONEL METAL POINTS

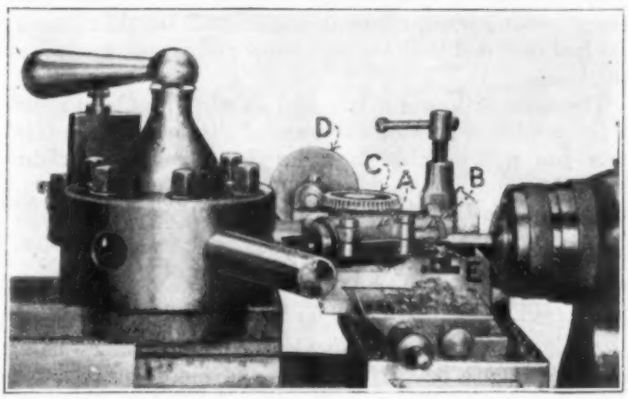


FIG. 2. THE POINT-FINISHING TOOL IN POSITION

Monel metal, being cold-rolled to shape, often comes to the user with a varying degree of density and hardness which causes considerable trouble in turning. This may be overcome by normalizing the bars before turning. A temperature of 1,000 deg. F. for 15 min. and air cooling is the normalizing prescription

An Interesting Spline Gage

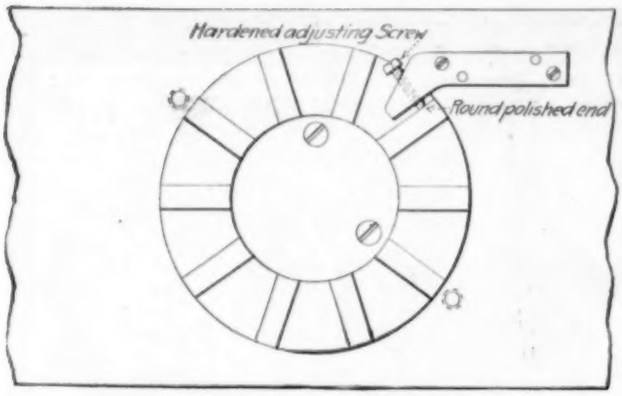
By Richard F. Moore

In reference to the article under the title, "An Interesting Spline Gage" on page 1109, Vol. 51 of the *American Machinist*: I have found such a method as Mr. Thayer used to be far from the best and will endeavor to prove why it is not good.

The principle that he used allows a small error to be cumulative. In other words, his first angle is, say, 0.0001 in. off, and on each set-up he gets that same "tenth" in the same direction (in all probability), so that by the time he has gone around the gage he will be off one thousandth, which would be anything but "exceptionally accurate."

I know of other methods to do this job, but I think the best is the one shown by the sketch herewith. The same fixture that Mr. Thayer used would be all right, but a stop should be used in connection with it instead of the sine bar. The stop does the trick—by setting the rounded and polished end of the adjusting screw against the milled surface in the groove next to the one you are grinding.

After a trial cut is taken all around in each space you will be within a couple of thousandths from the



THE GRINDING GAGE WITH A STOP

results of the milling job done before hardening. After going around once, all your angles will be alike except the last one, and that one will show your error magnified ten times.

The same principle is involved as when spacing around a circle with a pair of dividers. By two or three trial cuts you will be able to make the gage come around with the same angle at every stop and then, of course, you will have the right angle.

Device for Transferring Centers

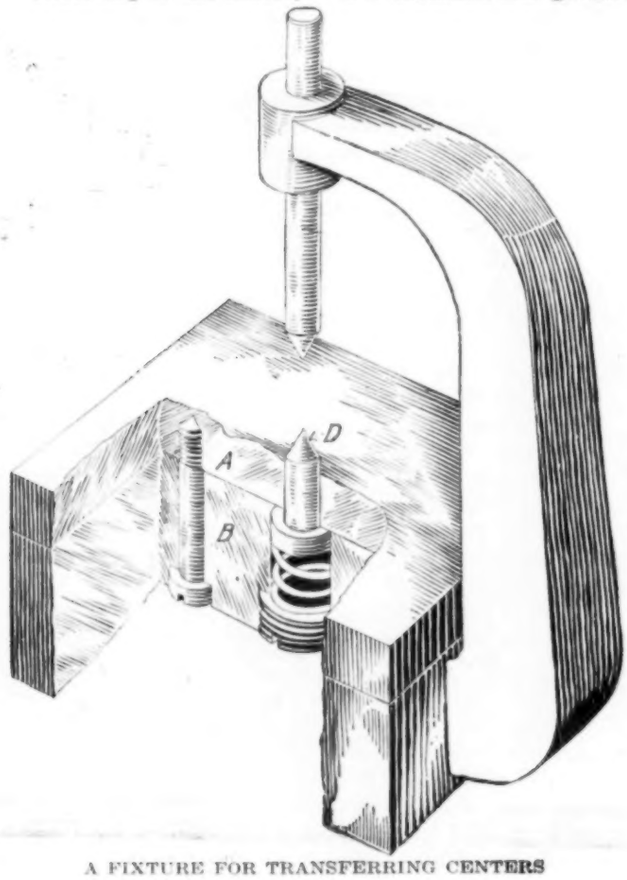
BY ROY V. TERRY

After seeing many toolmakers and diemakers using either a square or surface gage and plate for transferring a center to the opposite side of a die or flat plate, I wonder why more shops do not use a center-transfer of the kind illustrated.

Referring to the sketch, *A* is a hardened and ground plate screwed and doweled to the frame *B*. *C* and *D* are hardened and ground drill-rod or tool-steel points in line with each other and at right angles to the top of the plate *A*.

In operation, the die or plate upon which the center is to be transferred is laid upon the plate *A* with the point *D* in the prick-punch indentation and pressed down against the action of its spring until the work is flat on the plate. The tension of the spring serves to hold the work in position.

The point *C* is then let down on the work and tapped with a hammer. This device makes a much quicker and more accurate method of locating for relief drilling on small piercing dies, etc., than any other I have ever seen.

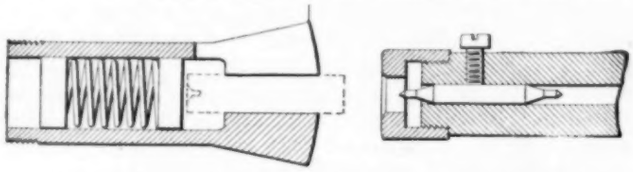


A FIXTURE FOR TRANSFERRING CENTERS

A Quick Centering Device for Screw Machine

BY A. J. ABREMSMEYER

The sketch shows a production method of centering on a hand screw machine. With this device I can center my work accurately and get the centers all of the same depth. Time is also cut in half as the work is done in one operation. The spring collet throws the piece out automatically.



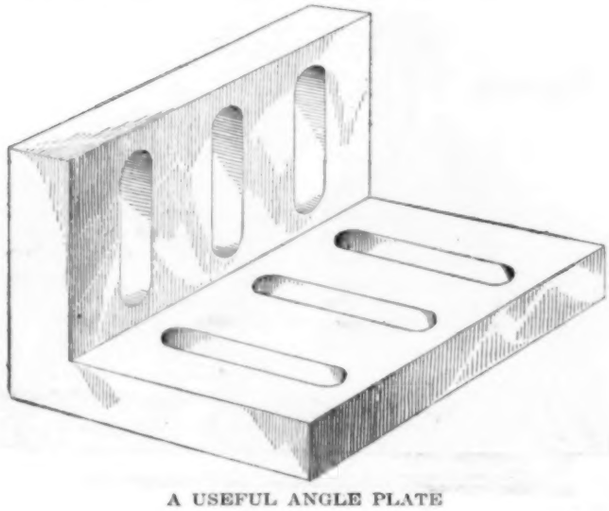
CENTERING DEVICE FOR THE SCREW MACHINE

A Handy Angle Plate

BY HUGH SCOTT

The illustration shows a convenient size and shape of angle plate for general shop use. It is 8 x 10 x 12 in. in size and 1¾ in. thick; finished all over. The absence of ribs, and the slots instead of holes, make it adaptable for clamping or strapping work of any ordinary size and shape, and being finished on the inside as well as the outside makes these extra surfaces available for setting up.

The angle plates should be made in pairs with all dimensions exactly alike.



A USEFUL ANGLE PLATE

An Open Letter to the World Trade Club

BY courtesy of what you describe as "an organization of 500 leading merchant-manufacturers of San Francisco," I am in receipt of a packet of literature advocating the universal adoption of the metric system, and asking me to "lend the weight of my influence" toward securing the passage of legislative measures designed to make its use compulsory.

You claim that our present system of weights and measures is "archaic," "cumbersome," "difficult to understand," and that it was "inherited from Germany," being "foisted" upon England by the Hanseatic Trade League and that England in turn "landed" it upon America.

In declining to countenance an effort to secure legislation both arbitrary and pernicious, the effect of which would be only to render confusion worse confounded, I beg to call your attention to statements in your propaganda that are misleading and to certain facts which you have overlooked or carefully suppressed.

Admitting that our system of weights and measures is archaic, I fail to see where any benefit is to accrue to us as a nation, or as a unit in world society, by "foisting" upon a so necessary and vital function of our civilization as our manufacturing industries a system that is based *not* as you imply upon science, but upon the entirely erroneous calculations of a French pseudo-scientist and evolved by himself in collaboration with a party of fanatical associates, to whom the business of bringing their pretty theories within the hard-and-fast limitations of manufacturing conditions was as vague as is the aforesaid manufacturers' idea of the latest nebular hypothesis.

The system with which you have become infatuated and the advantages of which you so ardently commend, is *not* metric (though you are apparently unaware of the fact) but *decimal*, and the decimal system is but incidentally associated with the meter. It can be applied to any unit — the inch, the pound, the gallon — with equal facility, as witness our decimal system of currency; and it is already constantly applied to our manufacturing standard of linear measure, the inch.

Your quarrel is not with the English System, but with the *binary* system, and the latter was introduced *not* by "Teutons of the Hanseatic Trade League" but by nature herself when she made it possible to divide a thing in two equal parts, and each part into two further parts, four of which would equal the original. It was this natural phenomena that made pints out of gallons and ounces out of pounds, and until you can bring forward a system that transcends the laws of nature, these divisions will continue to be made.

You say that the British and United States standards are not identical. This is true only in part, and the differences are due to local causes quite as likely to operate against the metric as any other system. Again you say that there are as many different bushels in this country as there are states in the Union, and cite the fact that a bushel of fine salt weighs 80 lb. while a bushel of bran weighs only 20 lb. How strange! Just what would be the difference in weight between a gram of feathers and a gram of lead!

You say that our thirty allies in the war (I didn't know we had that many) all used the impeccable metric system of mensuration in their manufactures of war implements, and but two benighted countries—England and United States—dragged along under the old standard. About what proportion of the war material used was made in these two countries? You admit in a later paragraph that in reference to general manufacturing they furnish about 80 per cent.

You hold up to our shamed vision the alleged fact that Borneo and Timbuctoo, in their advanced civilization, rely upon the "meter-liter-gram" standard and leave us to wonder if their enlightenment is because of it. I believe they also eat strange missionaries there. We are indeed in the dark ages.

You state that Germany, having discarded the old system (after having accomplished her fell purpose by working it off on England) adopted the metric system in 1871 and call my attention to the miracles that Germany worked in the way of devastation and destruction during the war. I submit that the system of measurement had nothing to do with what Germany did. All German guns, munitions and appurtenances of war were made in Germany. They began making them, it is true, in 1871, but it made not the slightest difference whether the guns were made to centimeters, feet, "cubits," or to a special size, which they might call a dodo, if they wished, so long as parts that were designed to go together would do so.

German efficiency was due to German military methods, German training and German unity of purpose; not at all to the German system of mensuration. Austria, Hungary, Bulgaria and Turkey were efficient allies of Germany, not because their manufactures in the way of implements of war were in accord with Germany's, but because they were willing tools or dupes of Germany. Bulgaria and Turkey did not furnish implements of war, but men; Germany furnished the guns.

You state that the opposition to the metric system is exemplified chiefly by a "clique of professional objectors centered in New York."

I know these objectors—some of them personally. They are the men who build 90 per cent of the machinery that is produced in this country. Few of them live in New York. If you really want to find some of 'em, look in San Francisco. They object because of their intimate inside knowledge of the difficulty of changing from one system, not any too good, to one that has absolutely nothing to commend it but the "World Trade Club," and the enormous expense entailed to accomplish—nothing.

You say in the form letter which you would have me sign and send to my State Senator or Representative at Washington that "probably 99 per cent of the people of the United States and Britannia are in favor of this simplification," etc.: Why, then, in the name of common sense, are the 500 leading "merchant manufacturers of San Francisco" sitting around a banquet table in a hall that is "27 meters long, 15 meters wide and 8 meters high" (I'll bet a metric dollar it was laid out with a two-foot rule, by a builder that never heard of the metric system), making speeches, collecting money and printing a bunch of junk with which to persuade them, when 99 per cent of all the people want to do what you want them to do, and there is only a paltry 1 per cent to stop them, and that 1 per cent made up "chiefly of a clique of professional objecters in New York?"

In the envelope that brought your communication to me there were twelve pamphlets, no two of which were of the same size. There were five circular letters, three of which were folded to different sizes and shapes. There were ten standard post-cards, *all alike*, $3\frac{1}{4}$ x $5\frac{1}{2}$ *inches*! Is this a silent argument for the efficiency of metric standardization?

Very truly,
HARRY SENIOR.

P. S.—Please: just what is a merchant-manufacturer?

Others Who Are Against a Compulsory Metric Law

Greenfield, Mass., Feb. 19, 1920.

Ethan Viall, Editor,
American Machinist.
Dear Sir:

You ask if we believe the metric system should be made compulsory. To this we answer "Positively, No."

You ask also, that if it were made compulsory, to what extent would our business be affected and what the change would cost. So far as we are concerned, as a manufacturing proposition it would not be so serious as it would be for the manufacturers who use the product which we would furnish. It would be serious with us were we forced to change from English to metric measurements. It would, however, be doubly serious to the manufacturer who was forced to adopt the metric system in place of the English, where the English is now in use. We, as manufacturers of tools, would naturally feel the change less than those in other lines, but we can see no good to come from a compulsory action of this kind.

Very truly yours,
Greenfield Tap and Die Corporation,
F. G. ECHOLS,
Vice President and General Manager.

East Moline, Ill., Feb. 17, 1920.

Ethan Viall, Editor,
American Machinist.
Dear Sir:

With reference to the movement now under way to force through a law compelling the use of the metric system, **I can think of nothing that would be more disastrous to American industry as a whole than a law of this character. When we take into consideration the enormous amount of manufacturing and engineering work that is carried on under the present system in this country, and the enormous amount of equipment, including jigs and fixtures, drawings and repairs which must be kept up for machinery that has been in service for years, we cannot but fully realize what it would mean to turn all our industries over to the metric system.** This question could perhaps have been advantageously taken up one hundred years ago, but to attempt to force it on the industries today would entail untold confusion and financial losses far beyond any possible hope of an offset return. It is my judgment that every effort possible should be put forth to defeat the passage of such a measure.

Yours very truly,
Root & VanDervoort Engineering Co.
and
R & V-Wagner Ordnance Co.,
W. H. VANDERVOORT.

Buffalo, N. Y., Feb. 24, 1920.

Ethan Viall, Editor,
American Machinist.
Dear Sir:

We wish to make ourselves clear in the subject of metric system and sincerely urge that everything possible be done to maintain the present standards of measurements, and not introduce the metric system which would require an entire change of engineering practice.

Very truly yours,
Buffalo Steam Pump Co. and
Buffalo Forge Co.,
EDGAR F. WENDT.

Newark, N. J., Feb. 26, 1920.

American Machinist.
New York.

Attention: E. Viall

We feel that the adoption of the metric system would prove one of the greatest sources of annoyance and needless expense to the manufacturers of machine tools, and therefore this movement should be defeated.

We are writing to our Congressmen and Senators and hope your efforts to defeat this movement will prove successful.

Gould & Eberhardt,
H. EZRA EBERHARDT.

World Recognized Associations That Are Against the Metric System

National Machine Tool Builders' Association

National Metal Trades Association

National Founders' Association

National Association of Manufacturers

Cleveland, Ohio, Feb. 24, 1920.

Ethan Viall, Editor,
American Machinist.
New York.
Dear Sir:

Relative to making the use of the metric system compulsory in the United States, we have given this matter serious attention during the past few years on account of the agitation in some quarters in view of this country adopting this metric system, and because of our increased interest in foreign business with countries using the system.

If this bill is intended to make the use of the metric system compulsory by the Government only, and on Government work, it would not be so serious a matter, and might ultimately be of benefit, and we presume this is what is intended.

We can hardly believe that it is contemplated to make it compulsory for all manufacturers, whether on Government work or not, as this would involve a tremendous expense to make the change in a short period of time.

It would cost us not less than $75,000 to $100,000 to make the change in our drawings and gages (and probably a great deal more), besides involving an additional cost and delay in educating our engineers in the metric system.

You may therefore set us down as decidedly opposed to such a procedure.

Yours truly,
The Wellman-Seaver-Morgan Co.,
S. H. PITKIN,
Vice President.

Another One On the World Trade Club

Cleveland, Ohio, March 6, 1920.

Ethan Viall, Editor,
American Machinist.
Dear Sir:

We notice in your issue of Feb. 26, 1920, on page 473, a copy of a letter written by the World Trade Club of San Francisco addressed to the Pratt & Whitney Co., the use of our name in connection with the adoption in this country of the metric system—the inference being that we were in favor of adopting it.

We desire to correct this impression and to say most emphatically, the name of our company was used without our authority and that we are emphatically opposed to the suggested change.

We will appreciate it if you will be kind enough to print this letter in your next issue.

Very truly yours,
The Standard Tool Co.,
H. A. HIGGINS,
General Manager.

Cincinnati, Ohio, Feb. 18, 1920.

Ethan Viall, Editor,
American Machinist.
Gentlemen:

Referring to proposed compulsory metric system law, kindly permit the Cisco Machine Tool Co. through the writer to join with its protest against the adoption of this system.

The machine-tool manufacturers in the United States are not only the largest machine-tool manufacturers in the world, but are producing the best and most accurate machines. Their machines are called for all over the world and are recognized as leaders.

American machinists are the best paid machinists in the world, and to bring into use the metric system which is entirely strange and foreign to the measurement standards to which they have been accustomed, would not only throw away millions of dollars worth of jigs and tools, but would also practically mean that every machinist in the country would have to start on a new system of education in order to learn the metric system thoroughly. It would mean chaos to American manufacturers; would result in an upheaval in every shop, and mean delays to all machine-tool manufacturers.

We sincerely trust that the bill may not go through.

Respectfully,
The Cisco Machine Tool Co.,
G. M. HORTON,
General Manager.

Boston, Mass., March 3, 1920.

American Machinist,
New York.
Gentlemen: Attention Mr. Ethan Viall, Editor,

Before writing you, I have gone into the matter very carefully with our engineers and superintendents as I wished to be in a position to write you exactly what it would mean to this company if the metric system was made compulsory.

In the first place we have at least $200,000 worth of drawings that would have to be practically replaced by new ones, made up under the metric system.

We have also several hundred thousand dollars tied up in engineering publications and catalogs that would have to be thrown away, and it would take at least ten years to refigure our capacity, tables or curves and convert same into the metric system. Not only do we own thousands of dollars worth of small tools and gages but also our employees and workmen personally own many of these small tools, and these of course would be of little value under the metric system, and would have to in most cases be discarded.

We have hardly a machine in our plant that could be operated without serious changes if the metric system is made compulsory, as our lead screws and gages on the machines would all have to be changed, causing months or years of delay and costing at least $300,000.

I am very much afraid that if the metric system was made compulsory tremendous unrest and discontentment among all skilled mechanics would result, accustomed and experienced as they are to the use of tools under our present system.

After thinking for years in inches and fractions of an inch it would really work great hardship on these workmen in trying to do their thinking in centimetres and metres etc.

While I agree that the metric system would have been a beautiful thing if it had been established at the time our currency system was put into effect, I strongly feel that if it was made compulsory now, by any legislation, that the confusion, delay and discontentment resulting on all sides would tremendously outweigh whatever slight value might be derived from it.

I sincerely trust that Congress will not attempt to force the metric system upon the people and the manufacturers of the country as it will surely mean another heavy load, that will greatly increase discontentment and seriously hurt for years production that is so urgently needed especially at the present critical time.

In conclusion I will say that it would certainly cost this company over $1,000,000 if the metric system was made compulsory, to say nothing of the delays and demoralization that would be bound to result, the cost of which it is impossible to estimate but which would be tremendous.

Very truly yours,
B. F. Sturtevant Co.
By E. B. FREEMAN,
Vice President.

Lorain, Ohio, Feb. 24, 1920.

American Machinist.
Gentlemen:

Regarding movement now under way to make the metric system compulsory, we wish to advise that we are very strongly opposed to this proposition.

At present, we are unable to estimate the cost to us of such a change

Yours very truly,
The Thew Automatic Shovel Co.,
C. A. WEBER,
Assistant General Manager.

Baltimore, U. S. A., March 4, 1920.

American Machinist.
Attention Ethan Viall.
Subject: The Metric System.
Dear Sir:

The proposed bill making the metric system compulsory would certainly work a hardship on the American industries at this time.

Responding to your letter of Feb. 18 we estimate that the changing over to the metric system would mean for us the changing of all drawings, gages, etc., and would probably delay our production about eighteen months.

This is probably the most inopportune time for such steps that could be found, as production is already way behind, and any such measure would certainly cripple American industry.

As it is the industries are besiged on all sides by problems, and their condition is worse than St. Paul's in his terrible predicament.

Every possible effort should be made to kill this bill.

Any steps that you might suggest where we could cooperate bringing pressure to bear we will certainly appreciate it and will do everything possible to lend our assistance and co-operation.

Yours very truly,
Standard Electric and Elevator Co., Inc.
By C. H. MOHR.

Cincinnati, Ohio, Feb. 23, 1920.

American Machinist.

Gentlemen:

In regard to the bill which is to be introduced in Congress, aiming to make the use of the metric system compulsory: We are quite sure that if it were generally understood just what the application of such a law would mean, it would have very few supporters, even among those who are now strongly for it.

The general impression seems to prevail that the industries could very easily and quickly change over to the metric system by merely re-figuring their drawings, substituting metric equivalents for inches. This impression would automatically disappear and the metric agitation would speedily subside if the general public could be made to understand that a change in the system of measurements carries with it a change in standards of manufacture.

If there is any merit at all in changing over to the metric system of measurements, the industries must carry it to its logical conclusion and adopt metric manufacturing standards; that is, standard metric commodity sizes. The adoption of metric commodity sizes is the only basis for the contention that a change over to the metric system will help foreign trade in some countries, but the metric advocates do not seem to be aware that metric commodity sizes are different from English or inch commodity sizes. We do not know of a better example to illustrate this than the one which we have often used before, which is the example of the milling-machine arbor. In all inch-using countries these arbors are made to the following standard diameters: 1 in., 1¼ in., 1½ in., 2 in.

Now the metric equivalent of the 1-in. arbor would be twenty-five and a fraction millimeters, but the actual manufacturing standard in metric countries is 27 millimeters, and the same is true of other sizes, as indicated by the table.

This same thing holds true of other parts of any machine and such things entering into machinery, as bolts, shafting, piping, etc. The application of this when translated into practice means the complete discarding of existing tools, jigs and fixtures, and their entire replacement with new ones made to metric standards. The direct expense involved, together with the expense of curtailed production, incident to changing over would be a good deal more than many manufacturers could bear. It must be remembered that the old fixtures and tools could not be changed over into the metric ones, even if their dimensions permitted this, because the old ones must be held for use when making repairs or replacements on existing machines.

STANDARD MILLING MACHINE ARBORS

Catalog No.	Dia. in Inches	Exact Metric Equivalent	Dia. of Nearest Equivalent Metric Standard Arbor	Metric Size Variation from English Sizes in Millimeters	Metric Size Variation from English Sizes in Inches	Manufacturing Variation Allowed (Accuracy Limits)
16	1	25.3998+	27	+1.6002	+0.0629998	0.0002
81	1¼	31.7497+	32	+0.2503	+0.0098543	0.0002
86	1½	38.0997+	38	—0.0997	—0.0039252	0.0002
103	2	50.7996+	50	—0.7996	—0.0315002	0.0002

This is based on the length of the meter = 39,370432 in.

If this question is again presented to Congress, for decision, we strongly advocate the appointment of a Congressional committee to make an investigation in the plants of various industries to ascertain its probable effect on manufacturing in the United States.

It may also be of interest to again point out that in such metric countries as France and Belgium, we are required **to supply cutter arbors made to the inch standards so that they can use their existing tools on those arbors.**

We have for a great many years been exporting our machines in large quantities to the so-called metric countries in competition with machines made in metric countries to metric standards, and we have yet to learn of a single instance in which the sale was in any way influenced by the system of measurement used in the manufacture of the machine.

We believe that a compulsory metric system law would lead to unnecessary confusion and prohibitive expense with no compensating advantages.

Yours very truly,
The Cincinnati Milling Machine Co.,
C. WOOD WALTER,
Vice President and Secretary.

A Few of the Automobile Companies That Are Against the Compulsory Metric Law

PACKARD MOTOR CAR CO.,
Detroit, Michigan.

WILLYS-OVERLAND CO.,
Toledo, Ohio.

REO MOTOR CAR CO.,
Lansing, Michigan.

AUTOCAR CO.,
Ardmore, Pennsylvania.

HAYNES AUTOMOBILE CO.,
Kokomo, Indiana.

INTERNATIONAL MOTOR CO.,
New York City.

MOLINE AUTOMOBILE CO.,
East Moline, Illinois.

MUSKEGON MOTOR SPECIALTIES CO.,
Muskegon, Michigan.

STANDARD MOTOR CONSTRUCTION CO.,
Jersey City, New Jersey.

FALLS MOTOR CORPORATION,
Sheboygan Falls,
Wisconsin.

SOUTHERN MOTOR MANUFACTURING ASSOCIATION,
Houston, Texas.

EDITORIALS

Unusual Information Concerning Milling, Boring and Tapping

THE article showing the methods used in the manufacture of recoil mechanisms for gun carriages, which begins in this issue, contains, perhaps, more suggestions for the progressive shop man than we are often privileged to present for his consideration. First, perhaps, is the detailed description of the methods used in removing very large amounts of metal by milling, and without distorting the finished product. The data in regard to the depth of milling cuts, as well as speeds and feeds, are well worth careful consideration.

One startling feature of these data is the fact that, under the conditions named, there is much less danger of the cutter breaking with an extremely heavy cut than where the cut is divided into two operations. Another suggestion along the same line is the construction of the milling-cutter arbor, where it was necessary to reduce its diameter below what was considered to be the safety point in order to clear the work. By confining this small diameter to as short a distance as possible and enlarging the arbor immediately above this point, breakage was effectually avoided.

The method of turning the trunnion by the building of a simple machine, the drilling and boring of the long holes, are all points which can be utilized by any good mechanic in a large variety of work. The method of lapping, especially the reasons for not supporting the lapping bars immediately at the end of the hole, can be easily applied to other work. Then, too, the experience in polishing which, of course, may seldom be necessary in actual manufacturing methods, is also one of the experiences to be tucked away in an engineer's private notebook.

This article is also an excellent illustration of the way in which information and experience can be applied to totally different work. The man who passes such an article by because he is not interested in recoil mechanisms, deprives himself of much valuable data on milling, boring, and lapping—data which are not available elsewhere. The ability to adapt ideas from one class of work to another is a great factor in making a man valuable. And one can usually find ideas in nearly every article, even in lines entirely different from his regular work.

Recruiting the Shop Force

THE question of industrial education has more sides than we usually consider. There is a crying need for a large number of skilled mechanics in many quarters and we are confronted with the very natural condition of not being able to reap where we have not sown. In other words, we have trained very few machinists during the past ten years, because some considered that it did not pay, or it wasn't worth bothering with boys, until we have worked the supply out—just as the farmers have worked out the soil in some sections.

Now we are trying to find a royal road by which to make a full-fledged machinist out of a boy or young man in a very short time, and there is disappointment in some quarters that the supply of boys anxious to learn the trade is not as large as might be desired. But there are several sides to the story.

We are apt to forget to what an extent conditions have changed during the last ten or twenty years, to overlook the passing of the demands for the old-time machinist in large numbers and the increased use of operators of special machines. The change has been recognized in some cases but we have not fully reckoned on its effect on the boy in all cases. We too often find only the question as to what we can get out of him, not what we can give or put into him. And the boy, alive with the spirit of the times, naturally wants to know where he "gets off," to use the slang of the day.

Leaving aside the boy whose leaning to the shop is so strong that you couldn't keep him out with a club, we have to deal with the average boy who has no special calling, and weighs the advantages of the different trades before deciding. If his sole aim is to make a fair living—and this probably obtains in most cases—is it any wonder that he looks with more favor on bricklaying than on learning to be a molder, or on some work where he can have shorter hours and wear better clothes than on either?

Have we gone about the matter of securing the right class of recruits with the same care and thoughtfulness that we use in other branches of the business? In too many cases the boy enters a shop because he must do something, rather than from any fitness for the work, and leaves it at the first opportunity to obtain better conditions than some of them provide.

We have been forced away from the old notion of "half a dollar a day" for an apprentice and are realizing that it pays to make the boy self-supporting and to pay some attention to him. But in too many cases the shops do not take into account the effect of cheerful surroundings on both young and old, or of an atmosphere with real live humanity in it, instead of only the grind of machinery. This does not mean that plush rockers should be part of every drill-press equipment or that vaudeville is necessary as a mental diversion. It does mean, however, that no live boy who is worth talking about, enjoys the prospect of becoming just a part of a machine, a mere gear in the feed train who is moved up or down a peg by the rate setter and his slide rule.

While some of these conditions have probably come to stay in modern manufacturing, it is expecting too much of an ambitious boy to choose voluntarily to become part of the plan without more advantages than are often held out.

In a recent conversation with an employer who was feeling something of the unrest that crops out here and there, he gave as his opinion that his men were perhaps less to blame for looking at things in a biased

manner than might be supposed. "They are running one machine day after day on one kind of work," he said, "until it becomes automatic and it leaves them practically free to think over the monotony of the work. They see it from one side only and their ideas become too firmly fixed to be easily dislodged."

Too few shop managers, busy every minute with multitudinous problems, realize as did this employer, the effect of the monotony of doing one thing day after day. He knew from experience.

It is with no spirit of pessimism that this is written. Every man who looks the conditions squarely in the face knows how they have changed and that they can never go back—in fact, it is probably not desirable that they should. Our problem is to meet the new conditions and solve the difficulties presented fairly and to the best interest of all concerned, for any other solution is but temporary and cannot be satisfactory to either party in the long run.

The question of properly training the boy is perhaps more important than that of getting him and keeping him contented, but this cannot be done until after he has been found and impressed with the advantages of becoming a mechanic. We believe a little more attention to the fact that he is a human being, not a part of the machinery, would greatly reduce the trouble caused by boys leaving after a short sojourn in the shop, and that it would be beneficial to all concerned.

An Experiment That Might Be Emulated with Profit

AN experiment leading to gratifying results in the way of stimulating the interest of machinists and toolmakers in their business has recently been put into practice by our contributor, Thomas Mateer, who is foreman of the machine shop at the plant of the Texas Steamship Co., at Bath, Maine.

There has been considerable discussion in the columns of the *American Machinist* as to what a machinist graduate of a trade school should know, and a list of questions by W. D. Forbes which such a man should be able to answer was published on page 169.

Mr. Mateer has taken most of these questions, added others as his judgment dictated and has compiled a catechism or questionnaire which he submitted to the men in his employ. The questions were arranged by points so that a possible score of 125 points was attainable.

One man made a perfect score, answering all questions correctly, and was awarded the prize—a new surface gage.

Revival of Immigration

One of the most encouraging developments in the industrial situation is the fact that the tide of immigration has begun to rise.

A Naples dispatch states that demands for passports to America far exceeds the transportation facilities.

Secretary of State Lansing says immigration is now at the rate of 540,000 a year, against 326,700 in 1915 and about 300,000 in 1916 and 1917.

The new tide of immigration is setting in more strongly from Italy than from Eastern Europe, possibly because potential immigrants from Eastern Europe have been unable as yet to get out of their own countries.—*The Supply Manufacturer.*

John Nazel

JOHN NAZEL, proprietor and general manager of the Nazel Engineering and Machine Works, Philadelphia, Pa., died on February 16, 1920. Mr. Nazel was born in Philadelphia on October 20, 1864, and has operated the engineering and machine works since 1900.

At an early age, being mechanically inclined, he commenced his apprenticeship as machinist, and in order to acquire a thorough knowledge of his trade, he secured employment for certain periods with the Keystone

Watch Case Co., Baldwin Locomotive Works, Thomas H. Dallett & Co., and Link-Belt Company.

After serving the last-named company for a number of years in a supervising position, he decided to engage in business on his own account and started in a small way in the basement at Ridge Ave. and 11th St. Due to his thorough knowledge of his trade, he soon built up a desirable patronage from leading manufacturers in the vicinity, and as a result was compelled to secure larger quarters, leasing the entire first floor of the 11th St. building.

Mr. Nazel designed and invented some valuable improvements to paper-making machinery, especially corrugated paper, and specialized on this class of machinery for quite a number of years, equipping some of the largest plants manufacturing corrugated paper in this country.

As his business was constantly growing and the facilities limited at Ridge Ave. and 11th St., he purchased the plant and equipment of the Corliss Engine Works, 4041 North 5th St., in 1907, where the business was located at the time of his death.

Mr. Nazel later became more deeply interested in metal-working machines than those for other purposes,

and seeing the market for forgings constantly increasing, in the year 1908 he started to specialize on forging hammers; as a result the Nazel pneumatic power hammer was placed on the market. Its decided merits and advantages were soon recognized by the trade and for the past few years the product of the plant has been nothing but hammers.

The business will be continued by his estate, under the management of his sons, Ralph W. and J. Milton Nazel, and C. H. Wackernagel, who has been connected with Mr. Nazel for the last 16 years.

Owing to Mr. Nazel's strong personality he acquired a large following of influential friends, not only in the machinery trade but in practically all walks of life, and due to his wide knowledge of current events and mastery of his business, his advice was sought freely and frequently, and generously given. It is needless to say that his loss will be felt keenly by his associates and all those who came in contact with him from time to time.

Spoiled Work and Its Prevention

Spoiled work, either from defective material or inaccurate workmanship, is a distinct loss, not only to the individuals but to the community. Any net reduction in the amount of spoiled work is a distinct gain to all concerned and is a real advance in the economy of manufacture.

The letters printed below from well-known firms show that the subject is being carefully considered in many cases. The causes and remedies suggested are of interest and should be carefully considered.

We believe that a frank discussion of this problem, not with a view of pointing out the faults of individuals concerned, but of suggesting remedies, will be of value to the machine-building industry as a whole. Preventing waste is about as important as making two blades of grass grow where only one grew before.

We believe that having the work inspected between each operation, issuing careful instructions to each workman as to the sequence of his particular operation, and as far as possible always giving the same job to the same man every time, are the most important factors.

The percentage of wastage is a very difficult thing to answer, but as nearly as we can determine from a careful survey of replaced parts, the spoiled work would not amount to more than 2½ or possibly 3 per cent.

We find that defective material is a most serious problem just at present. This is running as high as probably 4½ per cent. We have had on several occasions on certain castings as high as 100 per cent defective from the foundry; some defects of course do not show until after the machine work is done. This factor, when the delivery of castings is uncertain, is a very serious problem.

We feel that a very large percentage of the spoiled work in the average shop today is due to the present necessity of endeavoring to do good machine work with untrained men who are not particularly interested in the work they are doing.

THE BLANCHARD MACHINE COMPANY,
WINFIELD W. BLAKEMAN,
Superintendent.

All records of bad castings and spoiled work go immediately into the production and planning departments. Whenever the percentage of wastage is unusually high, an immediate investigation is made.

The object of the immediate investigation is twofold. First, it impresses on the man the fact that his work is carefully noticed, and so makes him more careful; secondly, it enables us to locate the cause of the trouble, and so possibly obviate same while the cause is still fresh in the workman's mind.

We do not keep a record of percentage of wastage, as we do not feel that such a flat percentage is of much value. What might be a high percentage for some kinds of castings (or some pieces) would be a low, or at least an allowable, percentage for others. We believe that the character and difficulty of the individual part must determine the allowable percentage of wastage for that part.

THE G. A. GRAY COMPANY,
AUGUST MARX,
Vice President.

In reply to your letter of Jan. 3, we submit the percentages of waste in our plant due to defective workmanship, defective material and engineering errors for the latter half of 1919:

Month, 1919	Defective Workmanship Per Cent	Defective Material Per Cent	Engineering Errors Per Cent
July	0.008	0.015	0.004
August	0.01	0.01	0.002
September	0.013	0.013	0.004
October	0.013	0.015	0.002
November	0.016	0.02	0.005
December	0.014	0.019	0.004

From our point of view, to decrease wastage, it is necessary that methods be standardized and to have someone in authority who will assume responsibility for results obtained, good or bad. This person should also have the ability to keep in close touch with the foremen and men, and by this means it is inevitable that an organization will obtain more production with less wastage.

THE KEMPSMITH MANUFACTURING CO.,
JOHN GOETZ,
Works Manager.

We have monthly departmental records showing the cost of factory supplies consumed. This is of valuable assistance in preventing the excessive use of miscellaneous supplies, such as waste, files, stationery, etc. The reports are sent to the various factory foremen each month to show the value of the supplies used in the respective departments. This gives the foreman a chance to make monthly comparisons and it gives the factory superintendent an opportunity to compare the supplies used by the different departments, in addition to the comparative department records.

One of the mistakes frequently made by factory managers and superintendents is depending, to a large extent, on inspectors to reject work spoiled in process. Most factories employ a large corps of inspectors. These are non-producers and the work they reject is partly, if not entirely, lost. We favor and work on the theory that it is too late to avoid waste by rejecting work spoiled in process. We employ more inspectors than should be necessary and are trying to reduce the number by placing greater responsibility on the actual producers, and increasing their compensation accordingly.

The responsibility for defective work should be placed on the foremen and the workers. The increased production of a careless worker is frequently more than offset by the work that he spoils. Every machine operator, or other producer, should be taught to realize that his value increases to his employer, provided he is a satisfactory producer, in proportion to the reduction in the amount of work spoiled in process. If this plan is generally understood by the employees, it increases production and is one of the best methods of avoiding waste.

We have no available figures of spoiled work which would be at all helpful in this inquiry.

LOCOMOBILE CO. OF AMERICA,
H. H. EDGE,
General Works Manager.

Patent Bill No. 11,984

THERE is no more important branch of the Government service than the Patent Office — nor one that has been more neglected in many respects. The employees have had but one general increase in salaries since 1848, and it is to the everlasting credit of those who are and have been employed there, that the records show but one in a position of responsibility who ever betrayed his trust.

As prices have mounted it has become increasingly difficult to hold trained employees or to obtain others. The bill given herewith offers some relief to the harassed Commissioner of Patents. It was passed unanimously by the House Committee and then went before Congress, and was passed March 5 by a vote of 272 to 6.

Regarding this bill, the Engineering Council passed the following resolution at a recent meeting.

Resolved: That the Chairman be authorized to arrange for sending notice by letter to the several societies represented on Engineering Council, urging them to use their influence in favor of the increase in salaries and staff proposed in the Nolan Bill, H.R. 11,984.

This resolution together with an appeal to engineers in general, was sent out March 3 over the signature of

EDWIN J. PRINGLE, *Secretary,*
Patents Committee, National Research Council.
CHARLES A. TERRY, *Chairman,*
Patents Committee, Engineering Council.
D. S. JACOBUS, *Representative,*
Am. Soc. M.E on Patents Committee of Engineering Council.

The bill is now before the Senate Committee composed of Senators Norris, Knox, Brandigee, Kellogg, Kirby, Smith and Gore. The chairman is Senator Norris.

It cannot be too strongly urged upon all engineers, manufacturers and others to whose interest the efficiency of the patent office is vital, that they help along the good work and use their influence toward the quick passage of the bill by the Senate.

Ethan Viall
Editor

An Act

To increase the force and salaries in the Patent Office, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 477 of the Revised Statutes be, and the same is hereby, amended to read as follows:

"Sec. 477. The salaries of the officers mentioned in the preceding section shall be as follows:

"The Commissioner of Patents, $6,000 a year.
"The First Assistant Commissioner of Patents, $5,500 a year.
"The Assistant Commissioner of Patents, $5,000 a year.
"Five examiners in chief, $5,000 a year each."

Sec. 2. That as much of section 440 of the Revised Statues as followed the words "in the Patent Office" and refers to said office only be, and the same is hereby, amended to read as follows:

"Chief clerk (who shall be qualified to act as principal examiner), $4,000; six law examiners, at $4,000 each; examiner of classification, $4,200; two examiners of interference, at $3,900 each; examiner of trade-marks and designs, $3,900; first assistant examiner of trade-marks and designs, $3,000; one second assistant examiner of trade-marks and designs, at $2,700, and one at $2,500; one third assistant examiner of trade-marks and designs at $2,200, and one at $2,050; six fourth assistant examiners of trade-marks and designs—two at $1,800 each, two at $1,650 each, and two at $1,500 each; examiners—forty-seven principals at $3,900 each; one hundred first assistants—forty at $3,300 each, thirty at $3,100 each, and thirty at $2,900 each; one hundred second assistants—forty at $2,800 each, thirty at $2,500 each, and thirty at $2,350 each; one hundred third assistants—forty at $2,200 each, thirty at $2,050 each, and thirty at $1,925 each; one hundred fourth assistants—forty at $1,800 each, thirty at $1,650 each, and thirty at $1,500 each; financial clerk, who shall give bond in such amount as the Commissioner of Patents may determine, $2,500; librarian, who shall be qualified to act as assistant examiner, $2,700; eight chiefs of nonexamining division at $2,500 each; eight assistant chiefs of nonexamining division at $2,100 each; private secretary, to be selected and appointed by the Commissioner, $2,000; translator of languages, $2,400 assistant translator of languages, $2,000; clerks—twenty-two of class four, at $1,800 each; thirty-three of class three, at $1,600 each; one hundred of class two, at $1,400 each; one hundred and twenty-five of class one, at $1,200 each; one hundred, at $1,100 each; skilled draftsmen, one at $1,800 and three at $1,600 each: three draftsmen, at $1,400 each; forty copyists, at $1,100 each: thirty-six messengers, at $1,080 each; thirteen laborers, at $1,080 each; forty-seven examiners' aids and thirty-nine copy pullers who shall be selected without regard to apportionment, $720 each;

"For special and temporary services of typewriters certified by the Civil Service Commission, who may be employed in such numbers, at $3 per diem, as may, in the judgment of the Commissioner of Patents, be necessary to keep current the work of furnishing manuscript copies of records, $7,500.

"For purchase of law, professional, and other reference books and publications and scientific books, and expense of transporting publications of patents issued by the Patent Office to foreign Governments, $10,000.

"For investigating the question of public use or sale of inventions for two years or more prior to filihg applications for patents, and such other questions arising in connection with applications for patents as may be deemed necessary by the Commissioner of Patents, and expense attending defense of suits instituted against the Commissioner of Patents, $2,500.

"For the share of the United States in the expense of conducting the International Bureau at Berne, Switzerland, $750."

Sec. 3. That section 487 of the Revised Statutes be, and the same is hereby, amended to read as follows:

"Sec 487. The Commissioner of Patents, subject to the approval of the Secretary of the Interior, may prescribe rules and regulations governing the recognition of agents, attorneys, or other persons representing applicants or other parties before his office, and may require of such persons, agents, or attorneys, before being recognized as representatives of applicants or other persons, that they shall show that they are of good moral character and in good repute, are possessed of the necessary qualifi-

cations to enable them to render to applicants or other persons valuable service, and are likewise competent to advise and assist applicants or other persons in the presentation or prosecution of their applications or other business before the office. And, subject to like approval, the Commissioner of Patents may, after notice and opportunity for a hearing, suspend or exclude, either generally or in any particular case, from further practice before his office any person, agent, or attorney shown to be incompetent or disreputable or who refuses to comply with the said rules and regulations, or who shall, with intent to defraud in any manner, deceive, mislead, or threaten any applicant or prospective applicant, or other person having immediate or prospective business before the office, by word, circular, letter, or by advertising. The reasons for any such suspension or exclusion shall be duly recorded.

Sec. 4. That the third paragraph of the Act of January 12, 1895 (chapter 23, section 73, Twenty-eighth Statutes at Large, page 619), as amended, be, and the same is hereby, amended to read as follows:

"Third. The Official Gazette of the United States Patent Office in numbers sufficient to supply all who shall subscribe therefor at $5 per annum; also for exchange for other scientific publications desirable for the use of the Patent Office; also to supply one copy to each Senator, Representative, and Delegate in Congress; also to supply one copy to eight such public libraries having over one thousand volumes, exclusive of Government publications, as shall be designated by each Senator, Representative, and Delegate in Congress, with one hundred additional copies, together with weekly, monthly, and annual indexes for all the same; of the Official Gazette the 'usual number' shall not be printed."

Sec. 5. That section 4898 of the Revised Statutes be, and the same is hereby, amended to read as follows:

"Sec. 4898. Every patent or any interest therein shall be assignable in law by an instrument in writing, and the patentee or his assigns or legal representatives may in like manner grant and convey an exclusive right under his patent to the whole or any specified part of the United States. An assignment, grant, or conveyance shall be void as against any subsequent purchaser or mortgagee for a valuable consideration, without notice, unless it is recorded in the Patent Office within three months from the date thereof or prior to such subsequent purchase or mortgage.

"If any such assignment, grant, or conveyance of any patent shall be acknowledged before any notary public of the several States or Territories or the District of Columbia, or any commissioner of any court of the United States for any district or Territory, or before any secretary of legation or consular officer authorized to administer oaths or perform notarial acts under section 1750 of the Revised Statutes, the certificate of such acknowledgment, under the hand and official seal of such notary or other officer, shall be prima facie evidence of the execution of such assignment, grant, or conveyance."

Sec. 6. That section 4906 of the Revised Statutes be, and the same is hereby, amended to read as follows:

"Sec. 4906. The clerk of any court of the United States, for any District or Territory wherein testimony is to be taken for use in any contested case pending in the Patent Office, shall, upon the application of any party thereto, or of his agent or attorney, issue a subpoena for any witness residing or being within such District or Territory, commanding him to appear and testify before any officer in such District or Territory authorized to take depositions and affidavits at any time and place in the subpoena stated. But no witness shall be required to attend at any place more than forty miles from the place where the subpoena is served upon him; and the provisions of section 869 of the Revised Statutes relating to the issuance of subpoenas duces tecum shall apply to contested cases in the Patent Office."

Sec. 7. That section 4921 of the Revised Statutes be, and the same is hereby, amended to read as follows:

"Sec. 4921. The several courts vested with jurisdiction of cases arising under the patent laws shall have power to grant injunctions according to the course and principles of courts of equity, to prevent the violation of any right secured by patent, on such terms as the court may deem reasonable; and upon a decree being rendered in any such case for an infringement the complainant shall be entitled to recover, in addition to the profits to be accounted for by the defendant, the damages the complainant has sustained thereby, and the court shall assess the same or cause the same to be assessed under its direction. If on the proofs it shall appear that the complainant has suffered damage from the infringement or that the defendant has realized profits therefrom to which the complainant is justly entitled, but that such damages and profits are not susceptible of exact calculation and determination, the court may, on evidence tending to establish the same, in its discretion, receive opinion or expert testimony, which is hereby declared to be competent and admissible, subject to the general rules of evidence applicable to this character of testimony; and upon such evidence and all other evidence in the record the court may adjudge and decree the payment by the defendant to the complainant of a reasonable sum as a royalty or general damages for the infringement. And the court shall have the same power to increase such damages, in its discretion, as is given to increase the damages found by verdicts in actions in the nature of actions of trespass upon the case; but in any suit or action brought for the infringement of any patent there shall be no recovery of profits or damages for any infringement committed more than six years before the filing of the bill of complaint or the issuing of the writ in such suit or action, and this provision shall apply to existing causes of action. And it shall be the duty of the clerks of such courts within one month after the filing of any action, suit, or proceeding arising under the patent laws to give notice thereof in writing to the Commissioner of Patents, setting forth in order so far as known the names and addresses of the litigants, names of the inventors, and the designating number or numbers of the patent or patents upon which the action, suit, or proceeding has been brought, and it shall be the duty of the Commissioner of Patents on receipt of such notice forthwith to indorse the same upon the file wrapper of the said patent or patents and to incorporate the same as a part of the contents of said file or file wrapper; and for each notice required to be furnished to the Commissioner of Patents in compliance herewith a fee of 50 cents shall be taxed by the clerk as costs of suit."

Sec. 8. That section 4934 of the Revised Statutes be, and the same is hereby, amended to read as follows:

"Sec. 4934. The following shall be the rates for patent fees:

"On filing each original application for a patent, except in design cases, $20.

"On issuing each original patent, except in design cases, $20.

"In design cases: For three years and six months, $10; for seven years, $15; for fourteen years, $30.

"On every application for the reissue of a patent, $30.

"On filing each disclaimer, $10.

"On an appeal for the first time from the primary examiners to the examiners in chief, $10.

"On every appeal from the examiners in chief to the commissioner, $20.

"For copies of records made by the Patent Office, excluding printed copies, 10 cents per hundred words.

"For each certificate, 25 cents.

"For recording every assignment, agreement, power of attorney, or other paper of three hundred words or under, $1; of over three hundred and under one thousand words, $2; and for each additional thousand words or fraction thereof, $1; for each additional patent or application included in one writing, where more than one is so included, 25 cents additional.

"For copies of drawings, the reasonable cost of making them."

Sec. 9. That sections 4935 and 4936 of the Revised Statutes be amended to read as follows:

"Sec. 4935. All patent fees shall be paid to the Commissioner of Patents, who shall deposit the same, less any sum or sum refunded under section 4936 of the Revised Statutes, in the Treasury of the United States in such manner as the Secretary of the Treasury shall direct.

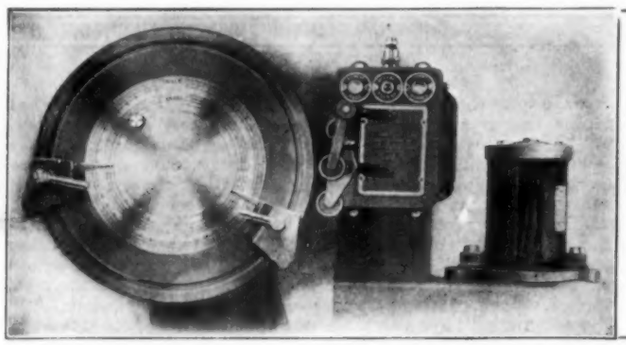
"Sec. 4936. The Commissioner of Patents is authorized to pay back any sum or sums of money paid to him by any person by mistake or in excess of the fee required by law."

Sec. 10. That the provisions of section 4934 as herein amended shall take effect July 1, 1920, with reference to the fee for issuing an original patent, and shall apply only to patents issued on applications filed after that date. The fees for issuing original patents on all other applications shall be as now provided by law.

Passed the House of Representatives March 5, 1920.

Attest: Wm. TYLER PAGE,

Clerk.



"Hiloplane" Electrically Controlled Planer

THE planing machine called the "hiloplane," illustrated in Fig. 1, contains a number of interesting features, including a reversing motor drive (current to which is supplied through a special generator set that is part of the equipment); magnetic feeds; the simplicity of setting the table stroke on a graduated dial, no table dogs being employed for this purpose, and the introduction of cross planing.

In its mechanical details the box-section bed, Fig. 2, is of an unusually substantial proportion. The driving pinions are forged solid with their shafts as the maker contends that at the speeds at which they run, solid pinions are safer in every way. One change of speed for slow-speed work is obtainable in the table gearing. The entire absence of belts, and the convenience of quick power traverses in all directions may be noted.

The most striking features, however, are the flexibility and ease of control obtained by the special system of driving and the magnetic feeds. The essential principle of the drive is the Ward-Leonard system of using a special motor-generator to supply current to an individual motor, the control of the latter being principally accomplished by manipulation of the fields of the former. The generator in common with the final reversing motor must be a direct-current machine, with independently excited fields. Variation in strength of the generator field provides a variable voltage with corresponding variation of speed in the final motor. This gives an infinite range of speed downward from a given normal by reducing the generator voltage to zero, although in practice the speeds are never reduced below 25 per cent of the normal on account of the reduced torque.

The overall range of the final reversing motor is usually increased to eight to one by the variation upward from the normal, by weakening the motor shunt field, the speed variation being accomplished by adjustment of resistance values in the generator and motor field. It is a simple matter to secure sudden alterations of speed at any part of the stroke ,and an accelerating switch is fitted on all "hiloplanes," which enables the cutting speed to be increased after the tool has entered the metal, or the table speed increased to that of the return speed, in order that gaps between surfaces may be quickly bridged.

An exceptionally wide range of feeds is obtained by the special magnetic feed control which is operated by solenoid and small separate motor illustrated in Fig. 3. Light feeds are obtained by solenoid control only; broad feeds are actuated by the motor controlled by the solenoid working in synchronism with it, the feed obtained being according to the position of the handle in the horizontal slot shown. The motor is only energized for a few seconds at the beginning of the cut and is fitted with an adjustable slipping clutch. The feed motor mentioned is also used for quick power traverse to the heads which are obtainable in all directions; also for cross planing, a unique feature very valuable for short bosses on large pieces, for jig work and vertical planing or slotting.

The control of table stroke or cross stroke to head for cross planing is exceedingly simple; this is clearly illustrated in the headpiece. The length of stroke is obtained by setting the dogs to the necessary graduations which are direct reading in feet and inches. The reversal

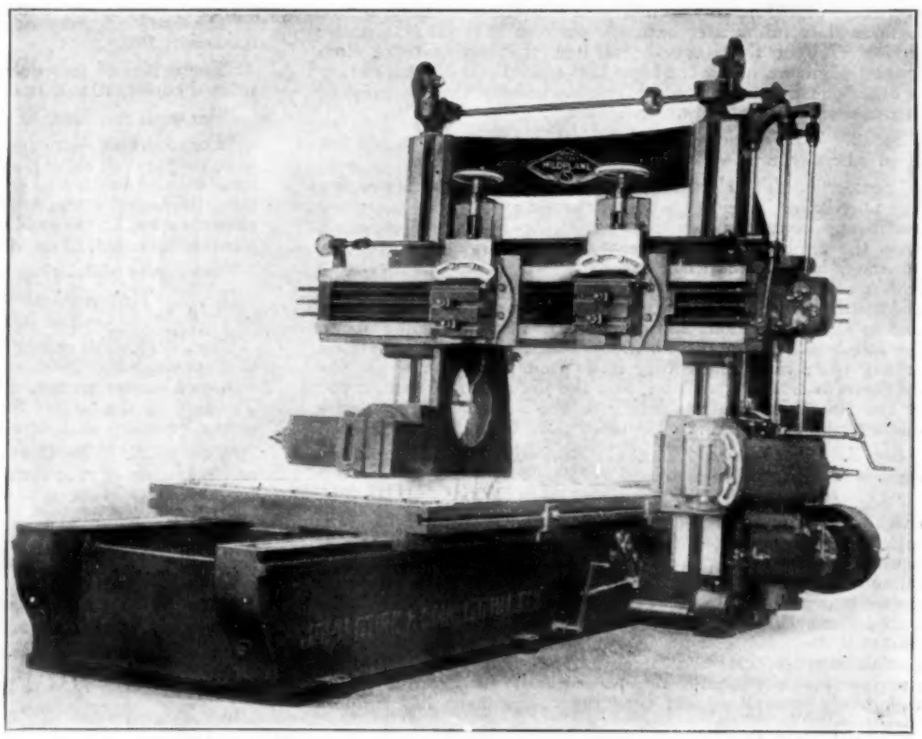


FIG. 1. THE ELECTRICALLY CONTROLLED PLANER

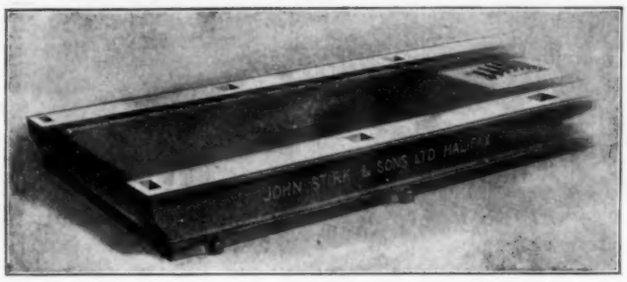


FIG. 2. THE BOX-SECTION BED

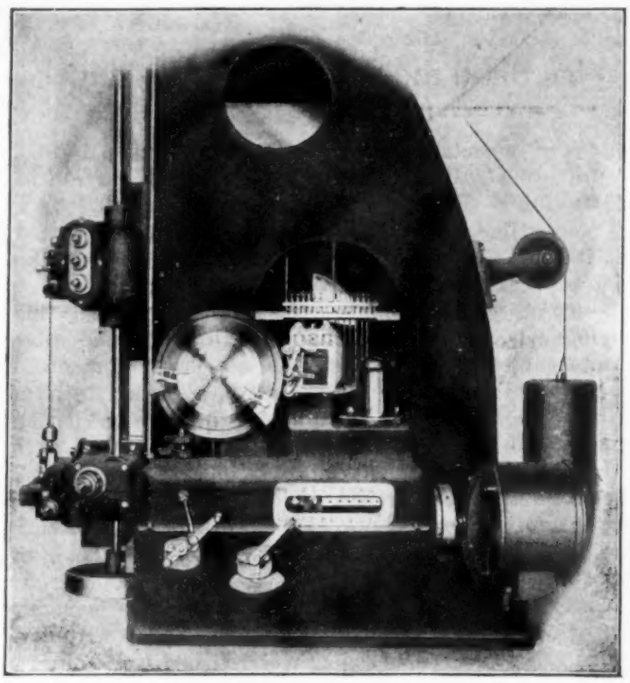


FIG. 3. MAGNETIC FEED CONTROL

of stroke is obtained by the action of the dogs on the master reversing switch shown in the same illustration. The combination enables a stroke of only 4 in. to be obtained on a 12-ton table. This stroke control entirely does away with table dogs and enables the operator to set both ends of the travel accurately from a given point. The table may be started or stopped at the master switch or from stations on either side of the bed; a hanging pear switch is also provided for convenience in setting up. It acts as an inching control. A safety switch is also provided to prevent the table running off the rack.

This planer is built by John Stirk & Sons, Ltd., Halifax, England, which firm is represented by Alfred Herbert, Ltd., New York.

The Clerical Man in the Machine Shop a Necessary Nuisance

BY HENRY G. FENN

That's me! At least I am considered as such from the viewpoint of you foremen and working mechanics. In other words, I am an executive clerical man in a large modern machine shop. Ah! Now you all recognize me and I feel sure that you are ready to admit that the title of this short article expresses just what you all think I am. You, of course, never tell me so personally in so many words but I have met many different types of men in several large manufacturing plants in the last twenty years. Nearly all of them carry their unspoken thoughts on their countenances. So much for what you think I am.

Now the purpose of this little sketch is to get myself before you in a different light from that in which you now see me. I shall try the almost impossible task of convincing you that my title has just one word wrong; that I am a Necessary Associate to you all.

To illustrate my point I want to repeat what my son once said to his mother. When a young man or rather still quite a boy he worked one vacation in the stockroom of a plant where I held a responsible executive position in the office. His duties brought him into the office occasionally in the vicinity of my desk. After a few days he came home at night and told mother that he never saw father do any real work; he merely sat at a desk all day long looking over and sorting out papers which he gave over to others to handle.

Now honestly, men, isn't this pretty close to what you also think about me? Incidentally, this young man has since completed his school course, learned his trade as machinist and is a foreman. He has never changed his early opinion about dad's duties, but you and he are wrong. It takes clear conception, an open mind, general knowledge, education, tact, anticipation of wants, etc., to supervise this clerical work.

To you the problem of entering an order for, say, fifty machines is as easy as rolling off a log—but is it? The clerical man has several things to think of in this apparently simple matter. He must secure an inventory of all finished parts and also of all unfinished castings and materials in stock. He takes these into consideration when ordering enough for the lot.

Then some parts of almost every lot are also used on other lots. This makes it necessary for him to know if the parts for the other lot have been allotted from stock on hand. He must also allow a certain percentage over for breakage, spoiled work, etc. After taking all these conditions into consideration he must buy in quantities to get the best price.

The clerical man has every mix-up, every mistake, big or little, to rectify on his many records. He must go slow, investigate snap reports of discrepancies, and personally secure actual conditions which as a rule are at variance with the first hasty reports If he is stubborn and refuses to move until he knows the facts he is a "mule." If, on the other hand, he takes your version offhand and it proves wrong he is the "goat."

Now in spite of the abuse heaped upon him the clerical man is indeed human.

This little article is an appeal to you men to take a new attitude and co-operate with him, loosen up, and explain to him in plain language what you are sure he is ignorant of in a mechanical way. You may be surprised to find out how quickly he will grasp your meaning and how anxious he is to learn your end of the problem so far as his clerical education will permit. It is readily granted that the average experienced clerical man is not usually an expert mechanic but his general knowledge gives him a clear conception of any problem once it is put squarely before him in terms not too technical for an ordinary man to grasp.

Let us all get together and treat the clerical man as a human being.

What the Worker Really Wants

In order to discover the workings of the laborer's mind, Whiting Williams, welfare director of the Hydraulic Pressed Steel Co., of Cleveland, left his executive desk. For nearly seven months he worked as a day laborer in the steel mills, coal mines and ore dumps.

As a result of his long and intimate contact with those who furnish the muscular energy essential to the operation of basic industries, Williams said he had reached the conviction that among the things on the worker's mind as primary causes of the strikes and other industrial disturbances prevalent throughout the nation and the world are:

The unholy alliance between tiredness and temper, between fatigue of body and mind, between soreness of muscle and soul. "The tired man most quickly becomes a grouchy man, and, conversely, the grouchy man most quickly becomes tired. The tired man does not want to think; he wants to feel." Therein, Mr. Williams believes, lies a great danger, for it gives opportunity for agitators to work upon the feelings and sensibilities of the worker, his reason not being appealed to.

The almost complete ignorance of the average worker as to the plans, purposes, ideals and character of his employer. "The worker is told little or nothing of these things. As a result, he uses his head and makes deductions. He sees prodigal waste of materials about the shop, perhaps, and decides: 'This company cares for nothing but big money. What do my small wages matter? And he proceeds to soldier on the job. The longer I worked in the mills the less I did, because of the 'underground' instructions, a tap on the shoulder, with such behests as, 'Lots of time,' 'Take it easy,' 'Don't kill yourself,' 'Twelve hours,' etc. The ignorance of the worker regarding the company's principles and purposes, the result of lack of interest by the company in its workers, causes lack of interest on the part of the workers, which costs the company money in inefficient work."

Ignorance such as this breeds colossal distrust of employers, Mr. Williams pointed out, and makes for deep-set conviction on the part of the worker that "delivering the goods" gets him nowhere, that "pull" rather than merit is the thing that counts with the employer, and that marrying the boss' daughter is the acme of favorable influence.

Using the simile of the "industrial sector," Mr. Williams urged efforts on the part of employers to make their workers feel that they have an opportunity to "break through." He would strive to give the latter the thrill of accomplishment, to inspire a sense of their own value in getting the work of the world done. He contrasted what is often the hopelessness of the worker's position in life with the thrills and opportunities of those farther up in the scale of human accomplishment, and said that the worker must be helped to find himself, to realize that his work, too, helps meet the needs of the world of human beings.

Mr. Williams said it was a mistake to conclude that all workers were radicals. The latter are a small minority, he finds, but they have a lead on the employer group, chiefly because they have been industriously engaged in putting salt on the raw spots among the workers, thus taking advantage of idleness, fatigue and soreness.

The average worker, he said, was trying to lead a reasonable and logical life, in as normal and wholesome a manner as his occupation and living conditions would permit. He was not a Bolshevik, in the main. When he will become such, if ever, depends upon you and me. The average man doesn't want to upset things, to take over the management of industries. He wants a steady, good, decent, interesting job. We should try to get to him, to meet him where he lives, after we are sure we have set our own house in order. This is no time to harden our hearts and clench our fists. What everyone needs is a cool head and a warm heart. It is time we stopped fuming and raving about the "wops." We couldn't get along without them, for they are doing work we would not do at any price.—*N. Y. Ad. Club News.*

What Shall the School Shop Produce?

By George Heald

A very important problem of the school shop is that of providing suitable product to carry out the course of training. This problem has been discussed very little in articles pertaining to vocational training, and yet it seems to be a source of constant worry on the part of instructors of machine-shop work.

When a machine-shop class is first organized this condition is not so noticeable, due to the considerable number of tools and appliances which must be made to round out the equipment, but after a class has been established for a few years and grows to about one hundred boys, the situation becomes acute.

I don't believe anyone will argue today that the work should consist of exercises which eventually find their way to the scrap box, nor is the work of constructing equipment for various departments of the school, in my opinion, sufficient either in variety or quantity.

One hundred boys in the shop three hours per day will, if kept busy and if they have the opportunity, produce a considerable amount of finished work during a two-year course, and this must be so if they are to be taught proper concepts of machine-shop procedure.

Must we continue to scour the school system for projects, which in many cases are unsuitable, in an effort to supply work? Should we make a marketable product to be sold to private concerns? Or, should we gather in material from neighboring manufacturers to be turned back to them when completed?

To build a marketable product might be objected to, both by employer and employee, and since the capacity of the school and the capabilities of the students would only permit the building of one or two simple machines, it might tend to make the training rather narrow in its scope.

The best solution seems to be the selection of a series of articles from local manufacturers which would be adequate in variety to teach the necessary processes. These articles or machine parts could be sold to the school by the manufacturer. The school would complete the work and when such work had passed inspection it could be sold back to the manufacturer at what it would have cost him to produce it. Part of the money might be used to aid in making the school self-supporting and part of it might go to the student. It would be quite an incentive to a boy to know that if he completed a job accurately and in reasonable time he would receive some compensation for it other than the usual percentage grade.

I would like to see a frank discussion of this problem through the columns of the *American Machinist.*

SHOP EQUIPMENT NEWS

-Edited By-
E. L. DUNN and S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and • equipment •

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs • and equipment •

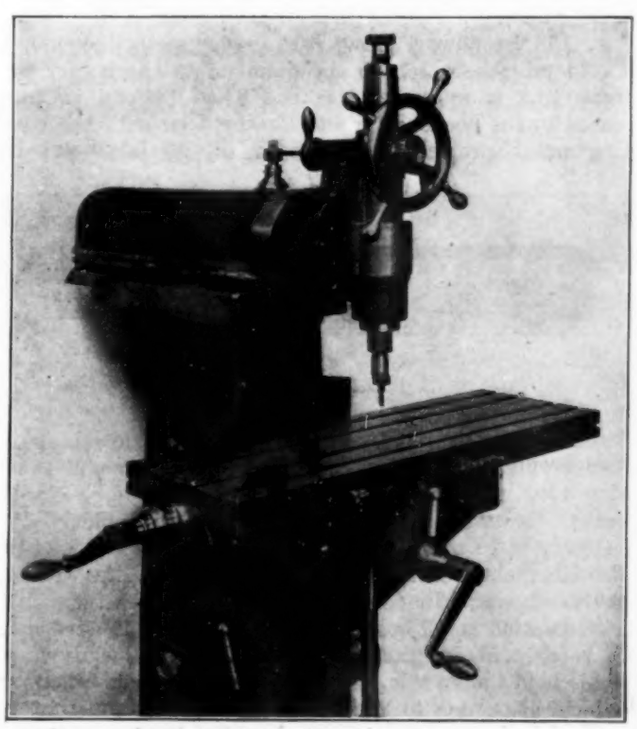
Pearson Precision Spacing and Boring Machine

The Modern Machinery Exchange, 25 Church St., New York, has placed on the market the spacing and boring machine illustrated herewith.

This machine is intended for use in spacing and boring jigs and in construction combines some of the features found in milling and shaping machines. The drilling head is mounted on the end of a ram and can be swiveled to any desired angle. The drive is from a cone pulley on the right-hand side through shafts and gearing to the spindle.

Both the ram and table carry adjustable micrometer heads opposed by stationary anvils on the frame and knee.

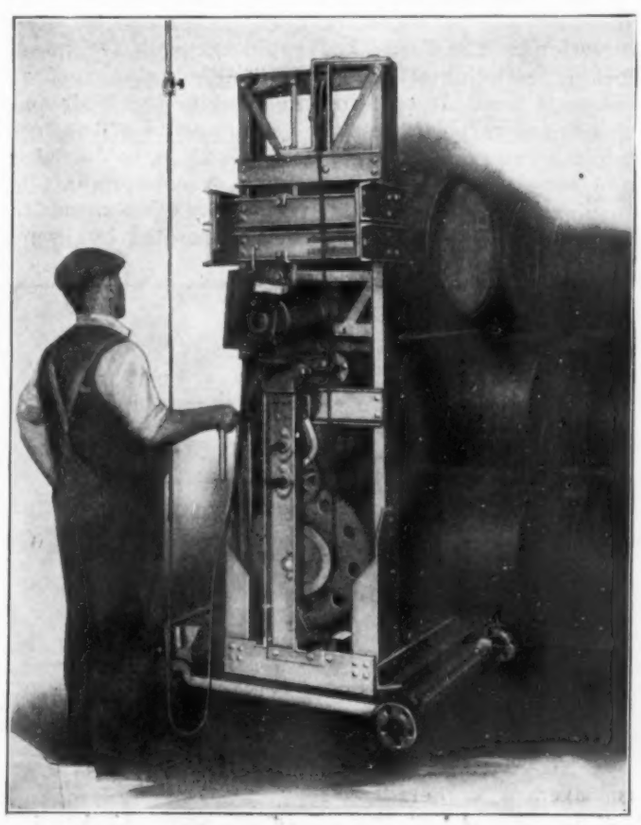
When the spindle is located for boring the first hole, end measures are placed between the micrometers. After boring this hole the location of the spindle for the next hole is found by removing the proper end measure and substituting another, differing in length by the distance between the holes, and adjusting the movable member until the end measure has the proper "feel" between the micrometer head and its anvil. It will thus be seen that the accuracy obtainable is only limited by that of the end measures and micrometers, and is not in any way affected by feed screws that may be of uncertain precision.



PEARSON PRECISION SPACING AND BORING MACHINE

Revolvator Tiering Machine

A tiering machine of improved design as shown is an addition to a line of similar machines manufactured by the Revolvator Co., Jersey City, N. J. Besides improved structural details, the new model is arranged for dual control, and may be hand or motor operated, the same crank being used in either case. When the motor is connected to an electric circuit, and the crank is attached to the switch, the car platform may be raised or lowered by shifting the position of the crank. The motor is of ½ hp. and can therefore be operated from any lamp circuit. Limit switches of a simple type are provided to prevent overrun. To change from power to hand operation the crank is simply moved to another position and used in the regular way. The advantage



REVOLVATOR TIERING MACHINE

of the combination control is obvious as the hand power arrangement is provided only for emergency use or where current is not available. The Revolvator is made in several standard types and in a number of different sizes that will raise loads from 800 to 1,800 lb. to various heights, the maximum rise being 18 ft. For greater capacities the machine will be built to order. The power equipment can be supplied for hand-operated machines now in use.

Moline Nos. 4 and 5 Horizontal Boring Machines

The Moline Machinery Co., Moline, Ill., has brought out the two horizontal boring machines shown in Figs. 1 and 2 and known as its Nos. 4 and 5. These machines are designed for the boring of crank and

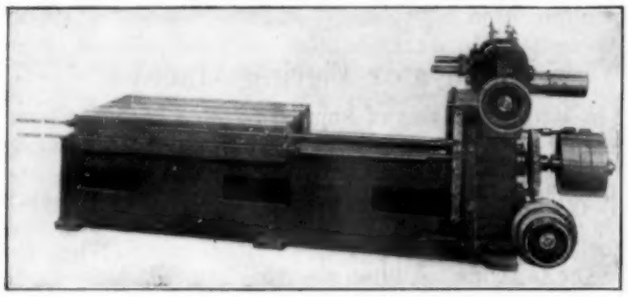


FIG. 1. MOLINE NO. 4 HORIZONTAL BORING MACHINE

transmission cases, but can be adapted to other work where a single-purpose machine is required. The table has a narrow guide on the bed, wide-surface bearing ways, and four T-slots on its top surface.

The table has three positive feeds toward the spindles and a rapid-traverse movement in both directions. The feeds and rapid traverse are interlocking, avoiding all danger of both being engaged at the same time. In building the machine the feeds and speeds are varied to suit the requirements of the customer. The two-pitch feed screw is 2½ in. in diameter and runs in a hard bronze nut. A countershaft is furnished with the machine which gives two speeds to the spindles. All controls can be operated by levers from either side of the machine. The control levers are also provided with adjustable automatic stop bars extending the full length of the table.

Both machines are built standard up to the head or rail. The No. 4 machine takes a rail and horizontal adjustable head. This machine is recommended where there is a series of holes to be drilled and the job can be conveniently set to bring all holes into a horizontal plane.

The No. 5 machine is recommended where two or more holes, not in a horizontal plane, are to be bored. In this case the machine is equipped with a group spindle head properly spaced and geared to meet the customer's requirements. For work of this kind the spindles are not adjustable. The entire head mechanism is driven through a helical gear and runs in an oil bath.

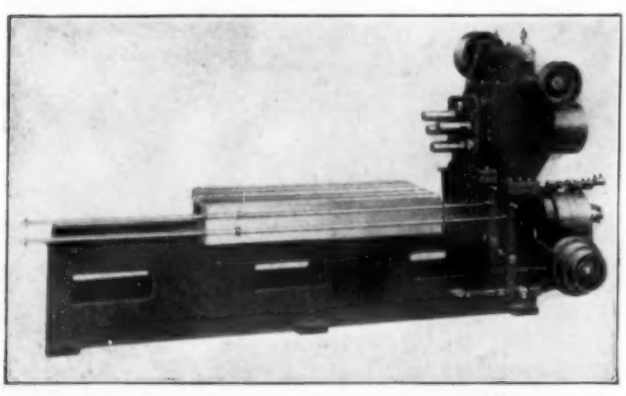
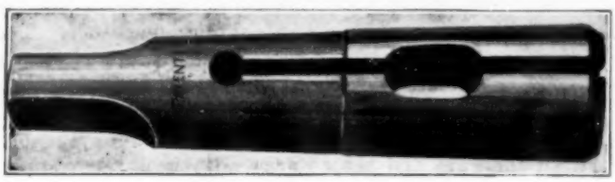


FIG. 2. MOLINE NO. 5 HORIZONTAL BORING MACHINE

Specifications: Working face of table, 24 x 48 in.; table travel, 48 in.; height of table from bed, 6 in.; height of table from floor, 26 in.; distance from table to top of rail on No. 4, 9½ in.; distance from table to lowest spindles on No. 5, 8½ in.; minimum center distance of spindles on No. 4, 2 in.; maximum center distance of spindles on No. 4, 26 in.; end adjustment of spindle on No. 4, 1 in.; spindles bored No. 4 or 5 Morse taper; weight of No. 4, 5,000 lb.; weight of No. 5, 5,400 lb.; floor space, 36 in. x 10 ft. 0 in.

"Utility" Tool Sleeve

The J. C. Glenzer Co., Fort St. W. and 14th St., Detroit, Mich., has added to its line the "Utility" tool sleeve shown in the illustration. This sleeve is in-



"UTILITY" TOOL SLEEVE

tended for use with straight-shank drills, reamers, taps, etc. It is made of 3½ per cent nickel steel, heat treated and accurately machined, and can be furnished in all the standard sizes.

The "Froidset" Diamond Holder

The "Froidset" method of setting diamonds for industrial purposes has been introduced by the S. Rose Co., Inc., 133 Broadway, New York. The method employs a cold process to secure the diamond to the holder by imbedding it in a steel jacket. The diamond is first placed in the pocket of a small receptacle, with the cutting point projecting. A layer of special metal is

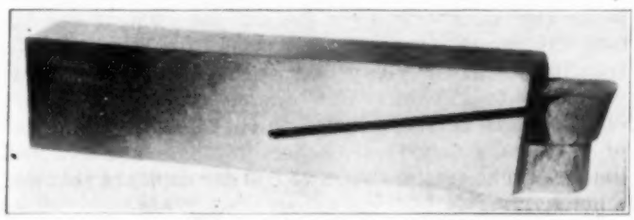
"FROIDSET" DIAMOND HOLDER

applied and the receptacle is then placed in the holder and screw pressure applied. This forces the metal to flow around the uneven surface of the diamond, thus forming a solid permanent matrix capable of resisting heat to the extent of 1,200 deg. F. The small holder may be screwed to a handle and used as a hand tool. It is also furnished suitable for attachment to the truing device of a grinding machine. Several types including a dismantled small holder are shown in the illustration. It is claimed for the method that the diamond when set is held immovable, that there is no carbonization or deterioration due to heat as in hot setting and that it is capable of many resettings. The small holder is

furnished to suit any style of grinding machine and when the diamond requires resetting it is necessary to return only the small holder. The line includes a number of different holders fitted with either black or bort diamonds ranging in size from one-fourth to three carats.

Martin Toolholder

The toolholder illustrated is a product of the Martin Tool Holder Co., Jackson, Tenn. In this holder short pieces of high-speed steel, broken ends of drills, etc., can be used. The toolpost screw secures both the holder and bit at the same time. It is claimed that this toolholder is particularly suitable for use in a four-way toolpost as the bit can be removed by loosening one setscrew and without disturbing the position of the



MARTIN TOOLHOLDER

holder which is held by the other setscrew. The holder is made of tool steel and is heat treated. It is made in all standard sizes, including the heavy-duty size (2¼ x 3⅜ in.) that carries a 1⅜-in. bit.

Ryerson-Glader Wire-Nail Machines

A line of wire-nail machines designated as the Ryerson-Glader machines, has been placed on the market by Joseph T. Ryerson & Son, Chicago, Ill. These are built in six sizes, similar to the one shown in Fig. 1, and range from the No. 00 to the No. 4 size. The production capacities of the six sizes range from 500 nails per minute for the No. 00 to 175 nails for the No. 4.

All important adjustments are within easy reach of the operator and can be made while the machine is running. All parts subject to strain or wear are of steel.

The wire is fed automatically from a bundle or coil

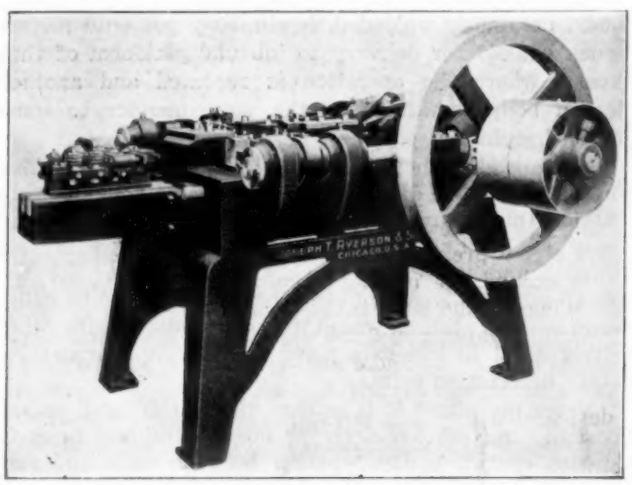


FIG. 1. RYERSON-GLADER WIRE-NAIL MACHINE

Specifications: Six sizes, from No. 00 to No. 4; capacities, No. 20 gage to 60d.; number of nails per minute, 500 to 175; horsepower required, ¾ to 7½; net weights, 900 to 7,600 lb.

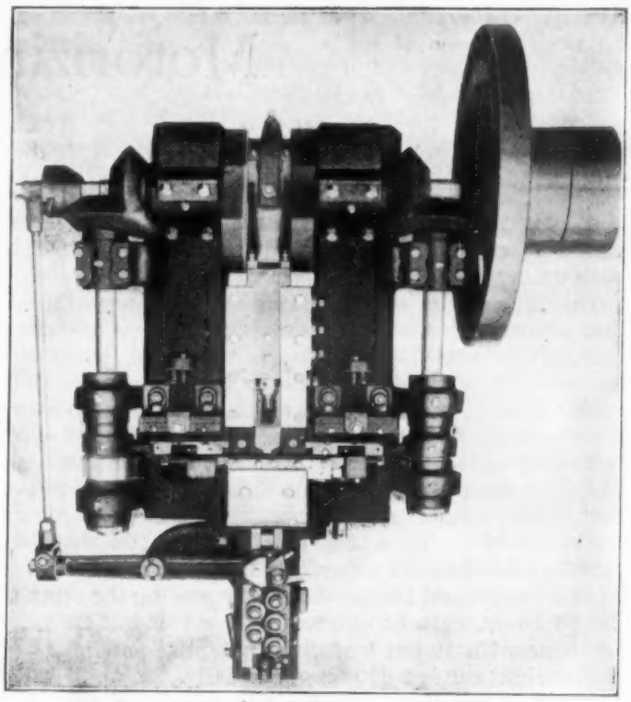


FIG. 2. TOP VIEW OF WIRE-NAIL MACHINE

between straightening rolls and then into the dies. While the wire is gripped in the dies the head is formed with one blow of the heading hammer, and as the latter recedes the straightener carriage moves forward the length of stock required for a nail. The wire is again gripped and the point-cutting dies both make the point and clip it off, leaving enough stock outside the dies to form the next nail head. In advancing, the heading hammer operates an ejector which removes the finished nail. The top view, Fig. 2, shows the operating parts of the machine.

The wire is straightened by the straightener rolls moving back over the wire while it is gripped in the dies. The crankshaft is counterbalanced to compensate for the thrust of the header cross-head. The equipment furnished consists of one set of gripping dies for the larger size of wire to be used in the machine, together with two pairs of point cutters.

Metric vs. English Decimal System

By Walter F. Belding
Mechanical Instructor, State Trade School, Putnam, Conn.

In the different articles in the controversy over the metric system I have not as yet seen the side of the working man brought forward. It is a foregone conclusion that it will cost the manufacturers millions of dollars to change over their jigs, fixtures, gages, etc., but that will not be the greatest loss. Every artisan will have to discard his present tools. One hundred dollars will not furnish much of a set of tools at the present prices, but a greater loss than that will be the disruption of the trades. It will take years to make the turnover. The younger class will have to learn it, the middle class will continually get the two systems mixed and the older class will not even attempt it. This has been my experience in attempting to teach it to a machinist of eighteen years' practice (and he was not a dull man); it was a slow process; he was continually getting the two systems mixed.

Motorizing Terminals*

By B. F. Fitch
President, Motor Terminals Co., New York and Cleveland

FOR years trucks have proved to be valuable transportation mediums, but their adoption and scientific operation have been ignored by railroads whose business was primarily transportation.

The ingredients to be considered in transportation-cost estimates are tons, miles and minutes. A team can successfully haul 75 ton-miles and a motor truck 500 ton-miles in a 10-hour working day. Compare this with railroad performance in which the average box-car movement is but 25 miles per day. If loaded with merchandise to but a 10-ton average, it discharges but 225 ton-miles in a 24-hour day. It is, therefore, obvious that box cars suffer a handicap.

Freight-house operating practice demands that box cars lie idle 10 hours a day. If utilized exclusively for transportation and kept continuously moving the remaining 14 hours, even at an average speed of but 20 miles per hour with 10-ton loads, the potential possibility of each freight car is 2,800 ton-miles daily.

There is practically no limit to what the rails will carry, if cars, when consolidated in trains, are at once started and kept continuously moving; therefore, it is logical to charge inadequate terminal facilities with the major portion of the box car's tonnage deficiencies.

The Prime Trouble

The prime trouble is that box cars have been assigned to a service for which they were never originally intended, and this make-shift usage has complicated switching interchanges at all terminal points to the detriment of high mileage efficiency of all cars.

Rail transportation cannot be greatly improved because locomotives are now practically up to the safety limits of rails and bridges and without increasing weight of locomotives, drawbar efficiency cannot be increased, and without an increase in drawbar efficiency transportation costs cannot be lowered. Thus, obviously the field for improvement is terminals.

Railroad transportation has outgrown railroad terminals. From outer classification yards to pier station delivery at New York the cost to carrier is not less than $3.50 per ton, and similarly at Philadelphia not less than $2.50 per ton, or a joint terminal cost of $6 per ton. Whereas, the main-line haul between these two terminals, if estimated at a maximum cost of 6 mills per ton-mile, suggests a transportation cost of 60 cents versus terminal costs of $6. Chicago is no better off than Philadelphia and the haul is about ten times as long; hence, joint terminal cost is as great as the transportation or rail haul cost from Chicago to New York.

Innumerable stations built over fifty years ago are still the intakes and outlets of our great transportation systems; no wonder the subject of terminals is a topic of nation-wide discussion.

Ideal joint terminals at a cost of $50,000,000 to $500,000,000 are possible in all of our principal centers, but present chaotic conditions considered who will assume the responsibility of such abnormal financing?

Every city in the country has its labyrinth of rails, team tracks, private sidings, obsolete main freight stations and substations, between all of which box cars are switched around. The innumerable switch cut movements and the cost of handling these cars over rails, to detriment of through traffic, is primarily responsible for excessive terminal expense.

Between all the widely distributed freight houses box cars are used in transfer service. When so used, they are termed "trap," "transfer" or "ferry" cars. For instance, in any city with seven non-competing railroads radiating to different sections, each line receives daily in its city cars with some freight for each of the six connections. Numerically this means forty-two cars in transit to and forty-two cars in transit from, a total of eighty-four cars. But due to yard interchange delays, these cars average a third day arrival instead of a second day arrival; hence, 252 cars are assigned daily to such service. Thus 75,600 car days are required annually.

This explains one of the reasons for car shortage and an operating abuse which has been obsoleted by the success of a *Motor Terminals* installation at Cincinnati Ohio.

The Installation

Briefly, this installation consists of overhead rails, electric cranes, electric hoists, motor trucks and a plurality of interchangeable motor-truck bodies. The system of operation requires an empty body for each station movement demand of railroad on its inbound main station platform. At the larger stations there are several locations for such body settings, thereby decreasing the trucking distance for freight. As the freight comes from the cars, it is trucked to the nearest location containing a body carded for any connection or any substation. When loaded, these bodies are sealed and under telephone order of a joint dispatcher, employed by the railroads, mechanically loaded onto trucks and thus routed over city's streets to connection.

On arrival at outbound platform of the connecting line, the body is mechanically removed and an empty body, previously unloaded, is similarly put onto motor-truck chassis for delivery to inbound platform of that house, where the operation is repeated and another loaded body forwarded in the same manner to some other freight house.

If the load happens to be to a sub-station, it remains on platform until dispatcher is advised by agent at sub-station that return load is available. Then the loaded body of inbound freight to that sub-station is forwarded and the motor truck exchanges same for the previously reported load of outbound freight to be delivered at main station, where it is consolidated with other city freight in line cars made up daily to innumerable other destination points.

From the above it is evident that all freight, except possibly the portion arriving during the last hour of station operating day, whether between main and sub-stations or between main stations of the various rail roads, is currently loaded and out of the terminal. Previously this freight by trap cars suffered an average three days delay and the shuttle movement of these

*Extract from a paper read at the convention of the Material Handling Machinery Manufacturers' Association, New York City, Feb. 26, 1920.

individual cars over terminal rails interferred with the group movement of complete cuts of station cars; hence the congestion which previously made Cincinnati notorious as a check-valve in rail routings.

In May, 1917, the Big Four Railroad permitted a test installation between its five main and sub-stations. A special committee was appointed to analyze the entire terminal and recommend what economies and benefits could be anticipated from completely motorizing Cincinnati's terminal.

The summary of this comparative report prophesied the following, and as a result contracts were negotiated:

Annual economy, $61,652.96.

Advance movement of freight, 52.4 hours.

Increase inbound platform floor area, 14.8 per cent.

Increase outbound platform floor arear, in ratio with station operation.

Increase main station trackage, 21.4 per cent.

Increase main station realty, 122,660 sq.ft.

Release 66,862.5 cars for line service, per annum.

Extension of present labor, 30.4 per cent.

Eliminating the rehandling of 86,976 tons of freight, lessens railroads liability of loss and damage.

In 1919 equipment orders were entered and railroads commenced station changes and superstructure construction. The terminal is not fully equipped. However, in recent analysis of accomplishments it is proved that, due to increased operating costs of railroads the prophesied 17.1 cents per ton economy is in practice actually a saving of 35.2 cents per ton and, therefore, the annual economies will be $126,507.75 instead of $61,652.46.

This service has proved that all widely distributed station facilities can be laced up as a unit without investment cost to the railroads, thereby giving to each and every terminal the benefits of a union freight station. The rates paid for the service are less than what interest charges alone would be on the cost of constructing a consolidated terminal. The operating program of railroads and the established perquisites of shippers are in no-wise disturbed, but the railroads at large through the influence of this current versus their past interrupted movements enjoy an increase of terminal rail, station rail and station platform facilities. This increase can be perpetually extended at minimum investment, in ratio with increasing tonnage demands, which naturally will accrue at any industrial city enjoying better shipping facilities.

What's in a Name?

By J. A. Raught

On page 278 of *American Machinist* E. M. Long wants to know the accepted dividing line between a worm and a helical or spiral gear. In answer to his query I would like to refer him to the "American Machinist Gearbook," page 163. Here he will find a model of spiral or worm gears with six different ratios.

In answer to Mr. Long's second question regarding the mandrels, I will say that in most cases I have found the large end to be the one where the size is stamped, although this has not always been the case. I think lathe mandrels should have the small ends marked "go" and the large ends marked "no go," although in a great many cases I have thought the only solution for this problem would be to have a shoulder on the large end of the mandrel.

What Business Men Can Do

On page 570 we called attention to the attempt of the House Appropriation Committee to strangle our foreign-trade service by cutting down the proposed appropriation from $1,658,000 to about $490,000. However, owing to the prompt action of individual business men of standing and of commercial organizations, the House has voted to appropriate approximately $910,000, which is practically the amount given for the current year. It took a two-day fight on the floor of the House to gain this, but it shows what real business men can do in an emergency against a committee with no business sense whatever.

While the appropriation is considerably less than should have been given, it is nearly double the amount the Appropriation Committee proposed to allow.

Of course this bill will have to be passed by the Senate before it is finally settled, but it isn't likely that the Senate will turn down anything so manifestly to the country's interest as this.

However—Isn't it about time to do something toward having responsible committees made up of men whose business experience will qualify them to decide right on such questions in the first place, and not have to be forced into it?

A Criticism of Device for Babbitting Bearings

By Milton Wright

There is an article on page 305 of the *American Machinist* in which John Vincent describes a device for babbitting bearings. This device consists of an arbor with four movable collars, the latter to be held against the ends of the bearing by means of U-shaped springs.

To use the device it would be necessary to bore the lips of the bearings to exact size in order to accommodate the narrow shoulders of the collars upon which he depends to center the arbor. It would also be necessary to face off both ends of the bearings, else the collars would not hold babbitt without gaskets, putty dams, or some one of the many expedients to which millwrights resort, and the use of which would render the collars a nuisance rather than a help.

If the device is to be used on repetition work, as in manufacturing, and the boxes are split as shown in the drawing, why not turn the arbor with permanent collars? The arbitrary dimensions of length of bearing, distance between bearings and diameter of bore are already imposed by the manufacturing requirements, so why not take advantage of them?

I have poured many hundreds of pounds of molten babbitt and it is my belief that a device of the kind shown would be more bother than it is worth.

What's All the Fuss About?

"Manufacturers seldom object to the use of the gram or the liter. Their objection is limited to calling an inch 25 millimeters."—*Arthur E. Kennelly, Electrical Expert, Massachusetts Institute of Technology and Harvard University.*

[The "fuss" is because manufacturers whose customers demand accurate machinery object to calling an inch 25 millimeters when it is 25.4001-millimeters. A little matter like 415-thousandths may not bother an electrical expert, but even a third-rate mechanic would lose his job if he couldn't work closer than this.]

Sparks from the World's

Aëronautical Session of Society of Automotive Engineers

Wednesday afternoon, March 10, of Aëro Week, was chosen by the Society of Aëronautical Engineers for its technical meeting in the Engineering Societies Building, on West 39th St. This meeting was followed by a dinner at the Hotel Astor at 7 o'clock.

The aëronautical vice president of the Society, Glenn L. Martin, presided over the meeting, which would have been better attended had the absentees known the value of the papers to be presented.

The first paper was by Lieutenant-Colonel V. E. Clark, of the Technical Section, Air Service, and dealt in a technical way with airplane performances at high altitudes, assuming that the engine power could be maintained constant. Colonel Clark brought with him some "movies" taken by the Army at McCook Field and Aberdeen Proving Ground.

The pictures showed the way in which the DeHaviland plane has been equipped with flotation gear for making forced landings on the water, and also showed in the air the actual drop of the wheels from the landing gear and the alighting of the plane on water.

The next views showed practical tests made on rubber-covered gasoline tanks with the machine gun firing, consecutively, armor-piercing, incendiary and ordinary bullets. This particular tank did not leak until the forty-seventh shot, after which, the metal in one corner of the tank had been entirely shot away and the rubber finally collapsed.

Ground tests were shown of a plane equipped with the Hart reversible pitch propeller. Methods of shifting the propeller blades were shown and also its remarkable braking effect on the taxying machine.

Following this came various views of parachute drops made by the students of the parachute jumpers school, at Dayton, Ohio. Each jumper was equipped with two parachutes in case of emergency. One was strapped to his chest and the other on his back. Free jumps as well as "pull-offs" were illustrated. The type of parachute used employed an auxiliary parachute of about six feet spread, making the opening of the main chute positive.

Most of the jumps were made by men standing on the lower wing and holding on to a strut; others were from the cockpit. The "pull-off" gets its name from the fact that the jumper maintains his position while pulling the check string of the parachute and is actually pulled off into space by the main parachute as it opens behind the wing.

The type of the jump to be employed from a burning machine consists of a jump from the cockpit and a drop from 300 to 400 feet before the check string of the parachute is pulled. This is done to prevent the parachute from being set afire from the burning airplane.

Colonel Clark also had pictures of Major Schroeder and his observer on the ground and in the air in the Liberty Lepere fighter equipped with supercharger.

The film ended with some views of aërial bombs taken from the plane which dropped them. It was interesting to note that the white-painted bomb, in almost every case, kept in the shadow of the airplane on the water until the splash indicated that it had reached its target.

Other papers were as follows: "Consideration of Landing Run and Getaway by Standard Types of Airplanes," by Alexander Klemin; "Effect of General Shape of Aviation Engines on Operation of Airplanes," by Grover C. Loening; "Some Factors in the Design of Airplane Radiators," by S. R. Parsons; "The Heat Treating of Brazed Fittings for Aircraft," by Archibald Black; "Flying an Aviation Engine on the Ground," by S. W. Sparrow.

In the evening the reception committee was on the job at six-thirty and got the diners off to a good start. The after-dinner speakers included Major-General C. T. Menoher, U. S. A., and Commander G. C. Westervelt, U. S. N., who spoke respectively on Military and Naval Aëronautics.

George H. Houston spoke on airplanes from the commercial viewpoint, and Major Maurice Connolly on some phases of civil aëronautics.

Colonel Thurman H. Bane, head of the Army Air Service, Technical Section, and Commodore Charleton, of the Royal Navy, were also called upon for a few remarks.

Factory Changes Hands

The Hardware City Manufacturing Co. of New Britain, new owners of the Elm City Brass Co. factory, will take possession of the property about May 1 and will manufacture trunk hardware. The new concern will make a number of alterations in the buildings and will install new machinery. The purchase of the factory was the result of a rush of new orders. The factory will employ about 100 hands.

Hudson Motor Car Co. Doubles Capacity

To meet steadily increasing demand for cars $5,750,000 has been expended by the Hudson Motor Car Co. during the past year for land, new buildings and equipment. Despite difficulties encountered in obtaining building material and new machinery, the capacity of the plant has been almost doubled, the actual manufacturing floor space being increased more than 50 per cent. Sixty-nine additional acres of land have been occupied near the main factory and more than 500,000 sq.ft. have been added to the floor space available at the beginning of 1919. A building devoted exclusively to the production of Essex cars, a complete axle plant and a thoroughly equipped heat-treatment unit have been built. A service building, said to be the largest in the world, is in course of construction. The plant used for the Essex is already in operation, while the axle and heat-treatment units are in partial operation, but will be running at full capacity in the next few weeks. In addition, the capacity of the power plant has been more than doubled and the machine equipment and production capacity of the main factory greatly increased.

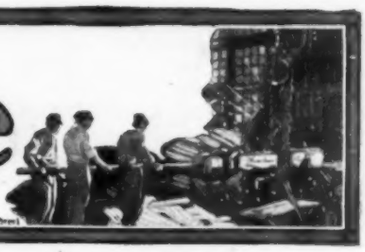
Honors for Factories

Major-General Clarence R. Edwards, department commander of the army of the northeast, has notified the following New Britain factories to send representatives to headquarters at Boston, Thursday morning at 10 o'clock, to receive decorations for meritorious war work:

Stanley Works, F. S. Chamberlain, representative; Corbin Screw, N. B. Ford, representative; Landers, Frary & Clark, representative not yet named; Stanley Rule and Level Co., F. S. Chamberlain, representative; P. & F. Corbin, J. W. Ryan, representative; North & Judd, F. S. Chamberlain, representative.

During the war the New Britain factories were pressed to the limit of their capacity and the Government inspectors were so favorably impressed with the co-operation received that the matter was called to the attention of the War Department. The decoration is in the form of a certificate congratulating and thanking all connected with the factories in any way. The decoration is recorded at department headquarters and at the War Department at Washington, D. C.

Industrial Forge



Bonus and Profit Sharing in Ontario Shops

The Gary Dort Motors, Ltd., Chatham, has announced that a bonus system will go into effect from the first of the year. The bonus will amount to 5 per cent of wages paid and is based wholly on punctuality and regular attendance.

The Dominion Sheet Metal Co., Hamilton, has granted to its employees a bonus of 10 per cent on wages during the past year.

The International Metal Works of Brockville, Ont., employing about fifty hands, has announced a profit-sharing scheme according to the following plan: At the end of the year 10 per cent of the profits is set aside for depreciation; a maximum of 10 per cent is then paid on the capital invested, and twenty-five per cent is set aside as a rest account to provide for losses or unforseen expenses. The balance is divided on a fifty-fifty basis between capital and labor. This applies to those who have been in the employ of the company for one year or more. Payments to employees are made in twelve or twenty-four installments, according to the method of payment, and they are divided pro rata, according to the earnings of each employee. At the end of five years, if there have been no losses, a further distribution is to be made from the rest account, on a fifty-fifty basis, between capital and the employees who have been in the service of the company for three years or more.

Ford Trade School a Philanthropic Institute

The enrollment of the Ford Motor Co.'s Americanization and vocation training school in Detroit has passed the 3,000 mark. There are four courses available to Ford men: The English course, trade school, service course and toolmakers' school.

A four-story 30-room building is occupied almost entirely by the educational activities of the Ford Motor Co., which teaches English to its foreign-born employees; its service men the proper method of repairing the Ford car; makes toolmakers out of the workmen who show their desire to advance, and takes boys under sixteen whose parents can no longer send them to school and gives them a combination of general schooling and toolmaking or other trade for which the boy shows a liking. This latter part of the school is known as the Henry Ford trade school and is regularly incorporated under the Michigan laws as a private school.

On entering this school, the boys are granted an annual scholarship of $400, which is paid them in bimonthly installments and helps to support them while learning a trade. Provision is also made for increasing this scholarship as the boys progress and attain higher marks in classroom work and shop practice.

Besides the four general courses are a number of special courses for foremen, for men whose work requires their having a knowledge of metals and a teachers' training school. All of the teachers in the Ford school are Ford men—men who because of some especial fitness or because of their ability coupled with an understanding of the "help the other fellow" spirit have been called to the work of teaching other Ford men. In all, there are seventy-five teachers in the Ford school which is more than the ordinary high school employs.

It must not be inferred that those men who are learning trades do all their learning in the school. They do not. Periodically they attend the classes to learn the theory but the experience they gain from actual work is in the factory. Practice and theory proceed together and all of the time the students are working on actual parts for Ford machinery or the Ford car, and they are being paid the regular wage.

THE DIRECTOR OF SALES announces that large quantities of hardware of various kinds are included in Surplus Property Division's List No. 6, to be sold through informal bids which will be received up to and including April 7th. Full information may be obtained by addressing any Zone Supply Office of the War Department, or the Surplus Property Division, Munitions Building, Washington, D. C.

Sessions of Pennsylvania Safety Congress

The Pennsylvania Safety Congress for 1920 will be held at Harrisburg, on March 21, 22, 23, 24 and 25. This congress is a continuation of the welfare and efficiency conferences which were held in the past. Due to the war, these have been discontinued since 1917. It is evident that too much emphasis cannot be placed upon the matter of industrial safety, with the purpose of reducing the great number of injuries and deaths. The arrangements for the congress are being conducted by the Department of Labor and Industry, which upon request will furnish programs and other information.

Trade Currents from New York, Cleveland and Cincinnati

NEW YORK LETTER

The local machine-tool market is unusually quiet at this writing. Although inquiries are numerous, the proportion of orders received in relation to the number of quotations sent out is quite small.

Featuring the week was a $1,000,000 sale by the Worthington Pump and Machinery Corporation to large oil interests who are constructing 600 miles of pipe line in the Coastal Oil fields.

There is some slight increase noticeable in railroad buying. The New York, New Haven and Hartford completed a list the past week and is reported about to enter the market again.

Although the New York Central is said to be out of the machine-tool market at present, it is expected to replace much of the equipment that will be taken over with its acquisition of several New York street-railway systems.

The American Locomotive Co. received orders for twelve more Pacific type locomotives from the Canadian National Railways which brings the total requirements for this road to sixty-seven engines.

Several new industries are reported for the past week, and can be looked upon as potential buyers in the machine-tool market.

Machine-tool deliveries are unimproved. Several concerns have refused to guarantee 1920 deliveries in certain lines. These concerns have made a number of quotations for 1921 delivery which have been accepted.

Conditions in the used-tool market remain undisturbed. There is a good volume of business showing with sales favoring woodworking equipment and small drill presses.

CLEVELAND LETTER

Further slackening off in machinery and machine-tool demand in the Cleveland market is noted during the last week or ten days. Even manufacturers and distributors who have not been affected by this slowing down now admit that orders are fewer and smaller. In only one or two instances is anything like a normal inquiry reported. Much of the inquiry now being received is for equipment that is difficult, if not impossible, to get at this time. This factor is having some effect upon demand also, leaders in the industry here believe, as the smaller consumer, with sufficient business on hand to make it worth while to add to his equipment, will not wait for his regu-

lar machinery house to deliver some months hence, but goes elsewhere in search of his equipment. Thus, it is considered largely a question of making delivery.

The larger outlet that was anticipated from the automobile industry, both in the Cleveland and Detroit sections, has not come to light so far, though it is admitted by both consumers and distributors of tools that added equipment is necessary if anything like the 1920 production anticipated some time back is to be delivered this year. However, the bulk of business still is coming from the motor-car interests.

Principal scarcity of equipment in this section is in milling machines, lathes and shapers, which appear to be wanted most.

The total volume of business created by these small orders is considered fair on the whole, though not up to expectations for this time.

That prospects for added equipment being needed in the immediate Cleveland territory are by no means dull, is seen in more plans for enlargement and the addition of more new industries in the Cleveland manufacturing trade. Among the latest developments of this character are the plans of the National Acme Co. to enlarge its plant, and the starting of construction by the Parish-Pool Co. of its plant on the South Side, where electrical furnaces will constitute much of new equipment required.

CINCINNATI LETTER

This machine-tool market continues to feel the strong buying demands. Delivery promises from some firms have been extended well into December of this year, while the earliest delivery in any line was one suggestion that there might be a few hand milling and grinding machines for sixty-day delivery. Those who have not made price advances in the past month or two are planning to do so immediately; one prominent maker of toolroom grinding machines has just wired his agents of a price increase, effective March 1.

A report recently given wide circulation to the effect that business was falling off and speculating whether this could not be charged up to price increases is said by responsible machine makers to be entirely unwarranted. A few large builders some time ago announced price increases which were dated far enough in advance to give most of their prospective customers a hurried chance to come in under the wire. This naturally drew in an unprecedented amount of orders for a brief period, and prospects who might otherwise not have closed for a month or two hurriedly placed their orders. The slight slack spell which followed was due to this business already being closed. A large builder states that had this extra rush of business been spread over the time it should naturally have occupied he would have termed it good.

The lack of material and men are the main features delaying production here as almost everywhere else. There is a shortage of cold-drawn shafting, and it is also found difficult to obtain an adequate supply of grey-iron castings.

Americanism Applied to Industrial Relations

(From *Industry*)

THE MOST vital question at the present time is the economic question as it is affected by both capital and labor. . . . A great deal of industrial strife can be avoided if employers take a human interest in their employees. It seems to me it would be wise for them to take as much interest in their workers as they do in their customers. They should pay their employees a living wage. This wage should be sufficient to enable the worker to build himself a home, to educate his family, to bring up his children in the proper way and to put something aside for his old age. The conditions under which he works should be as sanitary as it is possible to make them and he should be encouraged and given promotion if his work so deserves.

On the other hand, it seems to me that the working men should do their part in increasing production and in improving their efficiency. First of all, the working men should seek to do all that would increase their skill in turning out more work at the present time, so as to supply the needs of the world. They must realize that wages are paid from profits, and that profits cannot be made unless the material produced is of the very best and that it is produced in quantities sufficient to be able to compete with the production of other factories, mills and shops, which are working in the same field, and with the production of foreign countries. They must also realize that in order to get higher wages it is necessary to do their best and their utmost upon all occasions.—LEONARD WOOD.

New Officers of New Britain Machine Co.

Officers were elected and business of the annual meeting transacted recently by the New Britain Machine Co. The officers are: President, F. G. Platt; vice president, Mortimer C. Swift; treasurer, Herbert H. Pease; assistant treasurer, Abram Buol; secretary, Robert S. Brown; assistant secretary, Herbert E. Erwin; directors, the officers and S. P. Goss, Charles R. Hare, A. J. Sloper, Charles J. Parker and J. E. Cooper.

An "Increased Production Convention"

Seeing in increased production a means of restoring normal business and price conditions, the Chamber of Commerce of the United States, it was announced today, will make its eighth annual meeting, to be held at Atlantic City April 27 to 29, an "Increased Production Convention."

This subject is considered of such importance that in working out a program for the meeting every topic will be considered from this viewpoint. Lack of production, it is pointed out, is one of the chief causes of the high cost of living, which cannot be reduced until more goods are put on the market. The present is a seller's and not a buyer's market. Prices have been forced up by competitive bidding. This in turn has made necessary unusual wage increases, with a still further rise in manufacturing and production costs.

Even with the exchange situation as it is, with its threatened curtailment of exports to Europe, manufacturers generally believe it will be a long time before production in the United States catches up with the demand for goods. In the meantime producers are faced with the task not only of meeting current demands, but with making up in some directions production lost as a result of the diversion of manufactured goods for war purposes.

The general subject of increased production has been divided up in the program for the convention into subsubjects. The first to be taken up will be the Government in relation to production. Under this heading will be considered anti-trust legislation and taxation. Business of every kind is keenly interested at this time in the situation with respect to taxation, especially in the subject of excess profits taxes.

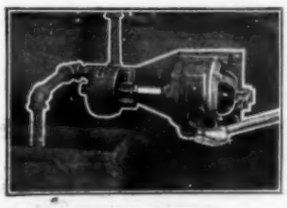
The second general subject to be taken up will be Transportation in relation to production. This will include both land and water transportation. One of the chief causes of lack of production just now, it has been pointed out, is the general shortage of railroad equipment. One authority estimates that the country is short at least 200,000 box cars and all lines of industry have felt the shortage.

(*Continued on Page* 648*d*)

Condensed-Clipping Index of Equipment

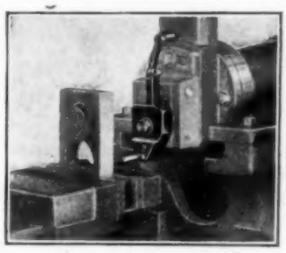
Patented Aug. 20, 1918

Pump, Fulflo Electrically Driven,
Fulflo Pump Co., Blanchester, Ohio.
"American Machinist," Feb. 26, 1920.



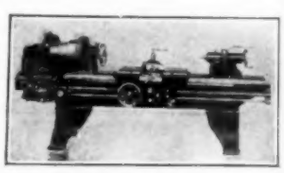
For permanent installation on machines provided with the company's drainage systems. It is possible to attach the unit at any convenient place, even where a belt-driven pump would be hard to operate on account of interference with the belt by overhanging or moving parts. Pump can be mounted above the level of the coolant, as it is claimed that it will hold its priming without the aid of check or foot valves. In operation attach the motor cord to a lamp socket.

Slotting Attachment, Bruno.
H. A. Moore Co., Rochester, N. Y.
"American Machinist," Feb. 26, 1920.



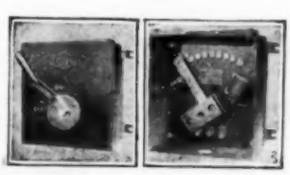
The Bruno slotting attachment for planers and shapers can be readily attached to the clapper of a shaper by removing the tool-post and using a clamping bolt furnished for the purpose. An adjustable friction arm provided with a spring buffer insures dropping into place of the clapper at end of the return stroke to prevent vibration of the tool. Cutting tools can be made of ordinary stock and may be turned to any position to cut on bottom, side or top. Three sizes are made taking tools with round shanks of the following sizes: No. 0, $\frac{1}{8}$ to $\frac{1}{4}$ in.; No. 1, $\frac{1}{4}$ to $\frac{5}{8}$ in.; No. 2, $\frac{5}{8}$ to $\frac{3}{4}$ in. Each size furnished with two cutting tools. Weight, 5 pounds.

Lathe, Morris 22-In. Engine.
Morris Machine Tool Co., Cincinnati, Ohio.
"American Machinist," Feb. 26, 1920.



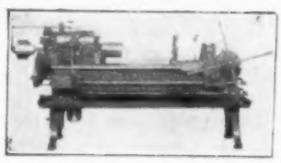
Specifications: Distance between centers (8-ft. bed), 3 ft. 6 in.; swing, over shears 23 in., over carriage 15 in.; front spindle bearing, $3\frac{1}{4}$ x 6 in.; hole through spindle, 2 in.; taper hole in spindle, Morse No. 6; spindle speeds, eighteen, 10 to 300 r.p.m.; countershaft pulleys, 16 x $4\frac{1}{2}$ in.; countershaft speeds, 165 and 200 r.p.m.; weight, crated 3,800 lb., boxed 4,750 lb.; size of case, 134 x 46 x 46 in.; cubic feet, 165.

Starter, Inclosed Faceplate Motor.
Cutler-Hammer Manufacturing Co., Milwaukee, Wis.
"American Machinist," March 4, 1920.



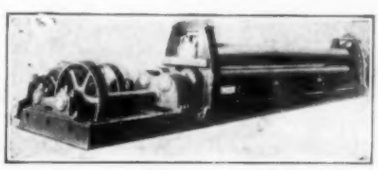
A pointer on the lever and legends stamped on cover indicate to the workman whether the starter is "off" or "on." The inclosed feature removes all danger from exposed parts, and protects button and segment contacts from damage due to fine collecting dust or spraying water. This starter, known as bulletin 2,111, is intended for small direct-current motors in exposed locations. It consists of the familiar type of direct-current hand starter inclosed in a sheet-metal case, having an external lever which engages the movable arm of the starter. The starter is made in capacities up to 50 hp., operating at 115, 230 and 500 volts.

Lathe, Boring.
Springfield Machine Tool Co., Springfield, Ohio.
"American Machinist," Feb. 26, 1920.



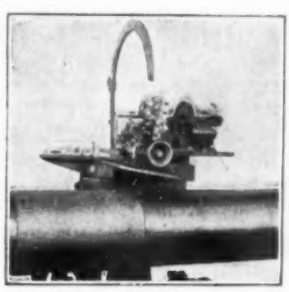
The lathe is intended only for boring and reaming operations at high speed. Has a geared head and the same system of clutch controls used on standard models of this make. Lead screw is omitted, as unnecessary. The air chuck is of the collapsible collet type. Carriage is the same style commonly used for boring spindles and axles. Steadyrest is of special design and consists of a counterbalanced quick-acting locking mechanism requiring a push of the hand to open it and a slight pull to close it.

Roll, Kling Bending.
Kling Brothers Engineering Works, Chicago, Ill.
"American Machinist," Feb. 26, 1920.



This machine measures 34 ft. 2 in. between housings, and has a capacity for bending $\frac{3}{4}$-in. mild-steel plates. Cut gears and bronze bushel bearings are used throughout. The top roll is 29 in. in diameter and weighs about 40 tons. The bottom rolls are 21 in. in diameter and each has two roller supports. The whole machine is built on a rigid cast-iron base. The drive is by two direct-current motors, one for the main roll drive, the other for power adjustment of the top roll.

Welding Machine, G. E. Automatic.
General Electric Co., Schenectady, N. Y.
"American Machinist," March 4, 1920.



The automatic arc welding machine is for use with the regular welding set, but designed to take the place of hand-controlled electrode. Consists of a pair of feed rolls driven by a small direct-current motor, which draws in and delivers to the arc a steady supply of wire and automatically maintains best working distance. The whole is controlled from a small panel. The panel carries ammeter and voltmeter for welding circuit, as well as rheostats, control relay, and contractors and switches for feed motor. Adjustment of the feed conditions made from the panel.

Truck, Haskell Shop.
Wm. H. Haskell Manufacturing Co., Pawtucket, R. I.
"American Machinist," Feb. 5, 1920.
(Note—This card supersedes previous card in which the manufacturer's name was incorrectly given.)

The body of the truck is made from $\frac{1}{8}$-in. stock, reinforced at the inside corners with heavy angle irons. The axle is made from a steel bar $1\frac{1}{4}$ x $1\frac{1}{2}$ in., the wheel bearings being turned to $1\frac{7}{16}$-in. diameter. The truck is made in one size only. Dimensions: Height, 26 in.; length, 44 in.; width, 26 in.; body, 21 x 31 in., by 13 in. deep; side wheels, 20 in. in diameter with $2\frac{1}{4}$-in. face; front wheel, 7 in. in diameter with $2\frac{1}{2}$-in. face; cubical contents of body, $3\frac{3}{4}$ cu. ft.; net weight, 300 lb.

Clip, paste on 3 x 5-in. cards and file as desired

International finance and its relation to world production has a prominent place on the program. This subject will be discussed both from the financier's and the business man's point of view. The Chamber has just expressed its willingness to name delegates to an international financial conference under limitations outlined by the Treasury Department. Lack of means of financing European industries is a decided factor in retarding production in many of the countries of Europe.

One general session of the convention wi'l be given over to agriculture in relation to production. Here will be presented for discussion the part of the government, the farmer and the business man in agriculture. Secretary of Agriculture Meredith will speak for the government.

Another important general subject will be the relation of labor to production. This will be approached from both sides, the employee's viewpoint being presented by a representative of the American Federation of Labor and the employer's by a business man.

Besides the general sessions there will be held group meetings, divided as along the great divisions of industry. In these meetings the subject of increased production, as in the general meetings, will be the main topic discussed.

Personals

B. L. WENNERSTROM, formerly with the E. L. Essley Machinery Co., Chicago, Ill., has been appointed vice president and sales manager of the Anderson Die Machine Co., Bridgeport, Conn.

F. C. HAESKE, formerly sales engineer for the U. S. Ball Bearing Manufacturing Co., is now with the production department of the Parish & Bingham Corporation, Cleveland, Ohio.

HORACE A. BROWN, JR., who has been identified with the Hyatt Roller Bearing Co. for the last nineteen years, has been promoted to the managership of the Motor Bearings Division with headquarters at Detroit.

EARLE M. PORTER has been appointed mechanical engineer for Giern & Anholtt Tool Works, Inc., Detroit, Mich. Mr. Porter was formerly connected with the Willys-Overland Co., Toledo, Ohio, as tool efficiency engineer.

N. CLAUSEN has resigned as equipment engineer of the Worthington Pump and Machinery Corporation, at the Epping-Carpenter plant, Pittsburgh, Pa., to take a position as plant superintendent of the John H. McGowan Co., Cincinnati, Ohio.

W. V. HOUCK, formerly factory manager of the Buffalo Metal Goods Co., located on Fillmore Ave., Buffalo, N. Y., a subsidiary plant of the General Motors Corporation, has severed his connections with that firm to become vice president and general manager of the O'Neil Iron Works, Inc., Buffalo, N. Y.

JOHN A. FITZGERALD, of Ogdensburg, N. Y., who recently returned from France after serving through the war as a K. of C. secretary, sailed for Havre on the "Lafayette," Feb. 26, 1920. In Paris Mr. Fitzgerald will assume his duties as managing director of La Societe de Machines Commerciales at France.

Business Items

The American Engineering Company has broken ground at Barnesdale, Ore., for one of its factories. This company has capital of $250,000.

The Dailey Automotive Products Corporation, Indianapolis, Ind., has been incorporated. The directors are Albert H. Dailey, Iva F. Carpenter and Carey L. Smith.

H. C. Durando announces that the H. C. D. Screw Machine Co., Hoboken, N. J., started its shop in operation on March 8. It is well equipped and able to handle screw-machine work of all kind.

The Phelps Foundry Co., Phelps, N. Y., has been incorporated recently to manufacture iron and steel products. The directors of this new company are: Walter R. Shover, Thomas Jones and C. P. Downs.

The Buffalo Forge Co., Buffalo, N. Y., held a meeting of its stockholders to appoint new officers as follows: Henry W. Wendt, president; Edgar F. Wendt, vice president and treasurer; Henry W. Wendt, Jr., vice president and secretary; C. A. Booth, vice president and sales manager. The new directors include the above named officers, and in addition H. S. Whiting.

The Foster-Johnson Reamer Co., Elkhart, Ind., has been incorporated under the laws of Indiana with a capital of $200,000. This new corporation will manufacture expansion reamers and the directors are: W. H. Foster, W. A. Kyte, W. T. Kough, Oscar Kylin and W. B. Johnson, with W. H. Foster as president, W. B. Johnson as vice president and Oscar Kylin as secretary.

Obituary

ARTHUR J. WILSON, sixty-one years old, of 789 Lexington Ave., formerly master mechanic of the Brooklyn Elevated Railroad Co.'s yards on upper Broadway and later with the South Brooklyn plant of the B. R. T. Co., died on Thursday, Feb. 12, 1920, from pneumonia.

SAGE W. SCHUYLER, vice president of the Dodge Manufacturing Co., Mishawaka, Ind., died Feb. 10 from pneumonia, aged sixty-five years. He was born in New York, graduated from Cornell University and was a member of the original Cornell crew. In 1893 he had charge of the Dodge exhibits at the World's Fair in Chicago.

Forthcoming Meetings

The National Federation of Construction Industries will hold its first annual meeting at the Hotel Sherman, Chicago, March 24-25. John C. Frazee, Drexel Building, Philadelphia, is executive secretary.

The Pennsylvania Safety Congress for 1920 will be held at Harrisburg, Pa., on March 21, 22, 23, 24 and 25.

The American Society Steel Treaters will hold a meeting at the Engineers' Club of Philadelphia, March 26, 1920.

The Association of Iron and Steel Electrical Engineers will hold a meeting at the Engineers' Club of Philadelphia, April 3.

The American Society of Civil Engineers will hold a meeting in Philadelphia on April 5, 1920.

The American Society Heating and Ventilating Engineers will hold a meeting at the Engineers' Club of Philadelphia, April 8.

The American Institute Electrical Engineers will hold a meeting at the Engineers' Club of Philadelphia, April 12.

The American Welding Society will hold its annual meeting at the Engineering Societies Building, 33 West 39th St., New York City, on Apr. 22, 1920, at 10:30 a.m. Howard C. Forbes is the secretary.

The National Metal Trades Association will hold a convention at the Hotel Astor, New York City, on April 19 to 22, 1920. H. D. Sayre is the secretary.

The National Chamber of Commerce will meet in Atlantic City, N. J., on April 26, 27 and 28.

The American Supply and Machinery Manufacturers' Association, the Southern Supply and Machinery Dealers' Association and the National Supply and Machinery Dealers' Association will meet jointly on May 17, 18 and 19 at Atlantic City, N. J., at the Hotel Marlborough-Blenheim. F. D. Mitchell is the secretary and treasurer of the American Supply and Machinery Manufacturers' Association, with an office at 4106 Woolworth Building, New York City.

The National Machine Tool Builders' Association will hold its spring meeting on May 20 and 21 at the Hotel Traymore, Atlantic City, N. J.

The American Society of Mechanical Engineers will hold its spring meeting at St. Louis, Mo., May 24, 25, 26, 27, 1920, and will have its headquarters at the Hotel Statler.

The American Iron and Steel Institute will hold its spring meeting at the Hotel Commodore, New York City, May 28.

The spring meeting of the American Iron and Steel Institute will be held May 28 at the Hotel Commodore, New York.

The American Society for Testing Materials will hold its next annual meeting during the week of June 21, 1920, at the New Monterey Hotel, Asbury Park, N. J. This society has its headquarters in the Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa. C. L. Warwick is the secretary and treasurer.

Boston Branch, National Metal Trades Association. Monthly meeting on first Wednesday of each month, alternating with the Employers' Association of Eastern Massachusetts. George D. Berry, secretary, room 50-51, 166 Devonshire St., Boston, Mass.

Engineers' Club of Philadelphia. Regular meeting the third Tuesday of the month. Lewis H. Kenney is the chairman of committee on papers.

Electric Hoist Maufacturers' Association. Monthly meeting at the offices of the Yale & Towne Manufacturing Co., 9 East 40th St., New York City. Secretary W. C. Briggs, Shepard Electric Crane and Hoist Co.

Engineers Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Pa.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadelphia, Pa., Howard Evans, secretary, Pier 45, North Philadelphia, Pa.

Rochester Society of Technical Draftsmen. Monthly meeting, first Thursday. O. L. Angevine, Jr., secretary, 547 Arnett Boulevard, Rochester, N. Y.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Sandblast, Cabinet, Rod-Cleaning.
Pangborn Corporation, Hagerstown, Md.
"American Machinist," March 4, 1920.

Cabinets for sandblasting rods of various shapes, ranging from ⅜ to 1¼ in. in size. Rolls and guides at each end of cabinet provide constant and uniform travel of rods through the blasting zone, the rolls being shaped to handle various sizes and shapes of rods to be cleaned. Six blast projectors are used and blast stream covers the entire circumference of rod. Bottom of the cabinet forms a hopper for storage of abrasives. Individual feed boxes, in plain sight of operator, supply abrasive to each projector, and connection to an exhaust system provides for removal of all disintegrated material.

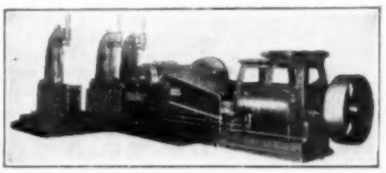
Micrometer, Direct-Reading.
J. T. Slocomb Co., Providence, R. I.
"American Machinist," March 4, 1920.

The counting wheels are 0.425 in. in diameter and are mounted on a sleeve that runs concentric with the spindle. A key in the spindle provides means for driving this sleeve and allow 1-in. traverse of spindle. Reading is direct on every thousandth and reads from 0 to 999. When the right-hand figure is about central with its aperture, the micrometer reading is correct within 0.0005 in. Where greater refinement is required it is necessary to refer to the nearest line on thimble and see how it corresponds with revolution line on the sleeve, but there is no calculating whatever. Screw is fifty pitch and there are 20 divisions on the thimble.

Handle, Skroo-Zon File.
Thurston-Bernay Co., Rialto Bldg., San Francisco, Cal.
"American Machinist," March 4, 1920.

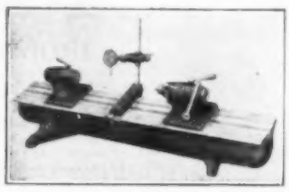
The handle screws on, cutting its own threads by means of two dies contained in a pocket in handle. Dies are made of hexagon steel, one smaller than the other, and are so spaced that they accommodate the taper on the file tang. A heavy-steel ferrule is provided to protect handle from splitting or other injury. Handles are made in nine sizes for files from 2 to 16 in., long. Larger sizes are suitable for soldering iron and scrapers as well as for files.

Saw, Newton U-96 Cutting-Off Cold.
Newton Machine Tool Works, Philadelphia, Pa.
"American Machinist," March 4, 1920.



The drive is from a belt-connected motor through worm and spur gearing. Wormwheel is bronze; the worm, hardened steel. Worm is provided with roller thrust-bearings. Feed and rapid traverse mechanism is inclosed with curtain covers and a positive safety release is provided for each extreme position of traverse. An oil and chip pan is cast on the base to drain lubricant to reservoir, a loose pan being fitted between the tables for draining to base pan. Specifications: Saw, 76 in. inserted tooth; capacity, 24 in. at one cut; platen, 60 x 56 in.; V-blocks, 3, fitted with arch clamps; V-blocks will hold work 32 in. in diameter.

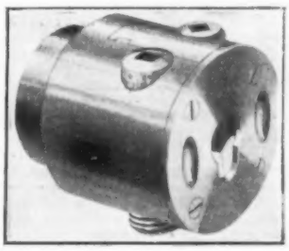
Centers, Bench.
American Gauge Co., Dayton, Ohio.
"American Machinist," March 4, 1920.



The bed is of box section and is supported on three feet. Top face of the bed is inclined, making it impossible to be used as a "catch all" for tools. The construction also facilitates the placing of large-diameter work as it allows plenty of room for the workman's hands. The bench centers are made in two sizes, 6 x 24 in. and 8 x 36 in. They are regularly furnished with a dial indicator reading to 0.001 in. the indicator is provided.

A fine adjustment for setting

Boring-Head, Drill Chuck.
Marvin & Casler Co., Canastota, N. Y.
"American Machinist," March 4, 1920.



The drill-chuck boring-head designated as No. 112 is equipped with two screws—one for gripping the drill and the other for controlling the offset. The offset screw is graduated to 0.001 inch. After a tool has been gripped by the jaws it can be brought concentric with the body of the chuck by turning the offset screw to the right. Specifications: Body, diameter 3 in., length 3⅜ in.; will take drills from 0 to ½ in.; will take boring tools from 0 to ⅝ in.; amount of offset with tools up to ¼ in., ⅜ in.; with tools up to ⅝ in., ⅝ in.

Pen, Drawing Tube.
Bourquin & Co., 1345 Main St., Waltham, Mass.
"American Machinist," March 4, 1920.

The pen proper is a tube. For use it is inserted in a swivel socket which in turn can be held in an ordinary writing-pen holder. The tube-pen can be filled with a pipette or quill. In use it should be held perpendicular to the paper, the swivel socket being adjustable to suit the usual position of the hand. Tube-pens are made in seven sizes from 0.012 to 0.090 in. and can be used either for free-hand or ruled work.

Lock Washer, Klingtite.
Klingtite Manufacturing Co., 37 Liberty St., New York.
"American Machinist," March 4, 1920.

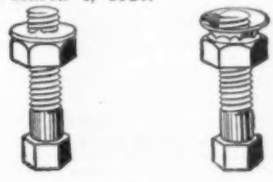


FIG. 1

The washer is bell-shaped, with a hole of irregular outline having inward projections. The locking feature is simple; the nut is first screwed tight, and the washer is then clinched in place, by using a short piece of pipe and hammer to flatten it against the nut. This forces the projections further inward, pinching the thread with a tight grip. Instead of a nut lock, the washer may be used to make a flange, or spool end, as shown in Fig. 2.

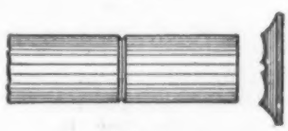
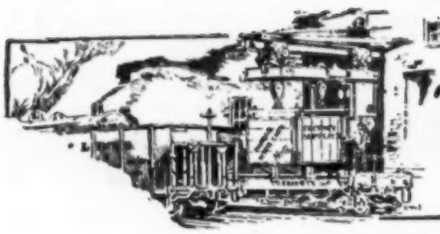


FIG. 2

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Month Ago
No. 2 Southern	$44.60	$44.60
Northern Basic	42.80	42.80
Southern Ohio No. 2	43.80	43.80
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	47.65	47.65
Southern No. 2 (Silicon 2.25 to 2.75)	47.70	47.70
BIRMINGHAM		
No. 2 Foundry	41.00	41.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	45.35–45.65*	45.35–45.65*
Virginia No. 2	43.25*	43.25*
Basic	43.00†	43.00†
Grey Forge	42.50*	42.50*
CHICAGO		
No. 2 Foundry local	43.25	43.25
No. 2 Foundry, Southern	46.60	46.60
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	43.65	43.65
Basic	42.90	42.90
Bessemer	43.40	43.40
MONTREAL		
Silicon 2.25 to 2.75%	43.25	43.25

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.97	$3.47	$4.07	$5.50	$3.97	$3.47	$4.07
Soft steel bars	4.12	3.52	3.97	5.00	4.07	3.52	3.97
Soft steel bar shapes	4.12	3.52	3.97		4.07	3.52	3.97
Soft steel bands	4.82	4.22	4.57	6.25			
Plates, ¼ to 1 in. thick	4.17	3.67	4.27	5.00	4.47	3.67	4.27

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.00	$2.90
Warehouse, New York	3.52	4.17
Warehouse, Cleveland	3.42	3.82
Warehouse, Chicago	3.52	4.10

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55–4.00	5.57–6.80	5.17	7.30	5.27
No. 12	3.60–4.05	5.62–6.85	5.22	7.40	5.32
No. 14	3.65–4.10	5.67–6.90	5.27	7.45	5.37
No. 16	3.75–4.20	5.77–7.00	5.37	7.55	5.47
Black					
Nos. 18 and 20	4.15–4.80	6.80–7.30	6.02	7.95	6.30
Nos. 22 and 24	4.20–4.85	6.85–7.35	6.07	8.00	6.35
No. 26	4.25–4.90	6.90–7.90	6.12	8.05	6.40
No. 28	4.35–5.00	7.00–8.00	6.22	8.15	6.50
Galvanized					
No. 10	4.70–6.00	7.50–9.00	8.22	8.50	6.65
No. 12	4.80–6.10	7.60–9.10	8.27	8.60	6.70
No. 14	4.80–6.10	7.60–9.10	8.42	8.60	6.85
Nos. 18 and 20	5.10–6.40	7.90–9.40	8.72	8.90	7.15
Nos. 22 and 24	5.25–6.55	8.05–9.55	7.12	9.05	7.55
No. 26	5.40–6.70	8.20–9.70	7.27	9.20	7.70
No. 28	5.70–7.00	8.50–10.00	7.57	9.50	8.00

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.40	$5.50
Flats, square and hexagons, per 100 lb. base	6.00	5.90	5.50–6.00

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	55
Cleveland	50
Chicago	50

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$21.00–26.00	$25.50–30.00
Cleveland	20.00	20.00
Chicago	16.50	16.50

In coils an advance of 50c. usually is charged.
Domestic iron (Swedish analysis) is selling at 15c. per lb.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire		Cast-Iron Welding Rods	
1, 11, 10, 9, 8, 7, 6, 5, 4, No. 8, 3/16 and No. 10, 1/4, No. 12, 5/16, No. 14 and 3/16, No. 18, No. 20	21.00 to 30.00	3/16 by 12 in. long	14.00
		1/4 by 19 in. long	12.00
		3/8 by 19 in. long	10.00
		1/2 by 21 in. long	10.00
		Special Welding Wire, Coated	
		1/4	33.00
		5/16	30.00
		3/8	38.00

Domestic 20c. for 1/16, 15c. for 1/8 to 3/16

MISCELLANEOUS STEEL—The following quotations in cents per poundare from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.00	8.00	8.00
Spring steel (light)	8.00	11.00	11.00
Coppered bessemer rods	8.00	8.00	6.75
Hoop steel	4.47	6.50	4.32
Cold-rolled strip steel	11.50	8.25	8.00
Floor plates	6.55	6.00	6.27

PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card, discounts on steel pipe, applying as from January 14, 1920, and on iron pipe from January 7, 1920.

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
1/8, 1/4 and 3/8	47%	20%	1/8 to 1 1/4	34 1/2%	18 1/2%
1/2	51%	36 1/2%			
3/4 to 3	54%	41 1/2%			

LAP WELD

2	47%	34 1/2%	2	28 1/2%	14 1/2%
2 1/2 to 6	50%	37 1/2%	2 1/2 to 6	30 1/2%	17 1/2%

BUTT WELD, EXTRA STRONG PLAIN ENDS

1/8, 1/4 and 3/8	43%	25 1/2%	1/8 to 1/4	34 1/2%	19 1/2%
1/2	48%	35 1/2%			
3/4 to 1 1/4	52%	39 1/2%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45%	33 1/2%	2	29 1/2%	16 1/2%
2 1/2 to 4	48%	36 1/2%	2 1/2 to 4	31 1/2%	19 1/2%
4 1/2 to 6	47%	35 1/2%	4 1/2 to 6	30 1/2%	18 1/2%

Stock discounts in cities named are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1/8 to 3 in. steel butt welded	40%	24%	40%	31%	54%	40 1/2%
2 1/2 to 6 in. steel lap welded	35%	20%	42%	27%	50%	37 1/2%

Malleable fittings. Class B and C, banded, from New York stock sell at plus 23%. Cast iron, standard sizes, net.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	19.00	19.25	16.00
Tin in 5-ton lots	63.00	60.00	72.50
Lead	9.50	8.75	5.25
Spelter	9.00	9.55	6.75
ST. LOUIS			
Lead	9.25	8.375	5.00
Spelter	8.75	9.225	6.40

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

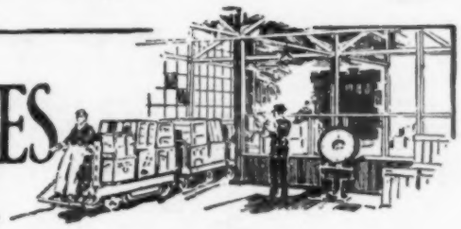
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	29.50	29.50	22.50	31@32	24.50	36.00	32.00
Copper wire (carload lots)	29.25	29.25	23.00	29.50	23.00	27.00	23.50
Brass sheets	26.50	26.50	18.75	29.00	25.00	27.00	29.00
Brass pipe	32.00	32.00	28.00	34.00	33.00	35.00	37.00
Solder (half and half) (case lots)	39.00	39.00	46.50	40.50	41.50	38.00	39.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	23.75	18.50
New York	23.75	19.50
Cleveland	27.00	24.00
Chicago	26.00	28.50

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f.o.b. mill..... 12.00

	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.00	14.45	15.50	14.80
New York	14.00	12.00	14.50	13.00
Chicago	15.00	22.00	15.00	21.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	12.00	7.50
Chicago	12.50	8.50
Cleveland	13.00	10.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	— New York —		—Cleveland—		
	Current	One Year Ago	Current	One Year Ago	Chicago
Copper, heavy, and crucible	16.50–17.00	14.75	17.00	14.00	17.50
Copper, heavy, and wire	16.00 16.50	14.00	17.00	13.00	16.50
Copper, light, and bottoms	15.00 15.50	11.50	15.00	11.00	15.50
Lead, heavy	6.75– 7.00	4.00	7.50	4.00	8.25
Lead, tea	6.00– 6.25	3.00	5.50	3.00	7.00
Brass, heavy	11.50–12.00	8.50	13.50	8.00	17.00
Brass, light	9.00– 9.50	7.00	10.00	6.00	11.00
No. 1 yellow brass turnings	9.50–10.00	9.00	10.50	6.50	11.50
Zinc	6.00– 6.25	4.50	5.50	3.50	7.00

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	33.00	34.00c.@35.00c.	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	33.00	25.00
Chicago	29.00	38.00
Cleveland	32.00	28.00

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	87.00	71.00	77.00	70.00	75.00
Commercial	50.00	42.00	21.50	18.50	15.00	15.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	— New York —		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$2.00	.80	$1.00	$1.25	$1.25	.98
Hot pressed hexagon	+ 2.00	.80	1.00	1.10	1.25	.78
Cold punched hexagon	+ 2.00	2.50	1.00	1.00	.90	1.00
Cold punched square	+ 2.00	2.50	1.00	1.00	.90	1.00

Semi-finished nuts, $\frac{3}{8}$ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	60%	50–10%
Chicago	50%	50%
Cleveland	55%	60%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
$\frac{1}{2}$ by 4 in. and smaller	25%	40+5%	35–5%
Larger and longer up to 1$\frac{1}{4}$ in. by 30 in.	15%	30%	25–5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York..... $1.50 Cleveland..... $4.50 Chicago..... $3.00

For cast-iron washers the base price per 100 lb. is as follows:

New York..... $7.00 Cleveland..... $3.75 Chicago..... $4.25

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
$\frac{1}{2}$ by 6 in. and smaller	15%	40%	30%
Larger and longer up to 1 in. by 30 in.	5%	20+10%	20%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	List	30%	List
Chicago	10%	List	10%	List plus 20%
New York	10%	40% from list	10%	20% from list

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel $\frac{1}{2}$ and smaller	30%	45%	45%
Tinned	30%	45%	45%

Boiler, $\frac{3}{4}$, $\frac{7}{8}$, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$6.00 Cleveland...$4.00 Chicago....$4.97 Pittsburgh...$4.72

Structural, same sizes:

New York...$6.10 Cleveland...$4.10 Chicago....$5.07 Pittsburgh....$4.82

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	33.50	36.00	35.00
Brass	32.00	34.00	34.00

For immediate stock shipment 3c. is usually added. The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 2c.; for lots of less than 75 lb., but not less than 50 lb. advance is 5c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb. 10c. should be added to base price; quantities from 10-25 lb., extra is 25c.; less than 10 lb., add 35c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as $\frac{1}{4}$-2 in. inclusive in rounds, and $\frac{1}{4}$-1$\frac{1}{2}$ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

COTTON WASTE—The following prices are in cents per pound:

	NEW YORK			
	Current	One Year Ago	Cleveland	Chicago
White	13.00	11.00–13.00	16.00	11.00 to 14.00
Colored mixed	9.00 to 12.00	8.50–12.00	12.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13$\frac{1}{2}$x13$\frac{1}{2}$	13$\frac{1}{2}$x20$\frac{1}{2}$
Cleveland	52.00	58.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.25	$2.25	$1.75
Philadelphia	2.00	2.00	1.75
Cleveland	2.50	2.50	2.75
Chicago	2.00	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.40	$3.40	$3.65
Cleveland	4.25	4.25	3.62
Chicago	5.00	5.00	4.125

COKE—The following are prices per net ton at ovens, Connellsville:

	Mar. 11	Mar. 4	Febr. 26	Feb. 19
Prompt furnace	$6.00	$6.00	$6.00	$6.00
Prompt foundry	7.00	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

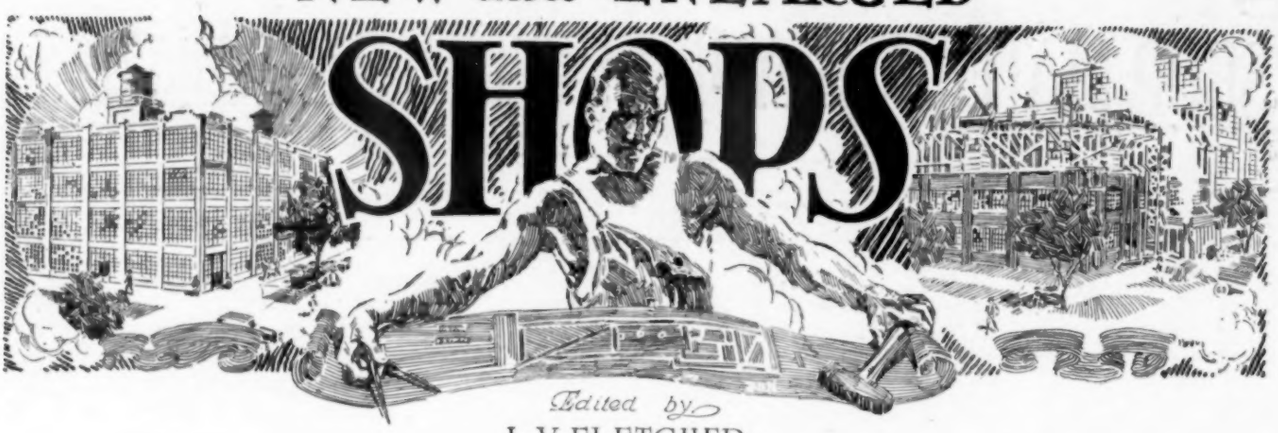
	— New York —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago
Raw in barrels (5 bbl. lots)	$1.80	$1.55	$2.00	$1.66
5-gal. cans	2.00	1.70	2.25	1.86

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	15.50	17.00	13.00	14.50	15.50	13.00
25 and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25
12$\frac{1}{2}$-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00

500 lb. lots less 10% discount. 2000 lb. lots less 10–2$\frac{1}{2}$% discount.

NEW and ENLARGED



Edited by
L·V·FLETCHER

Machine Tools

The following concerns are in the market for machinery and machine tools.

Mass., Boston — The Genl. Automobile Specialty Co., 151 Berkeley St.—punch press (used).

Mass., Boston—V. Peterson, 167 Olive St.—general machine tools for machine shop at Norfolk Downs, Mass .

Mass., Jamaica Plain (Boston P. O.)—The Clifton Mfg. Co., 65 Brookline Ave.—machine tools.

Mass., Woburn—The Atlantic Gelatine Co.—machine tools.

Md., Baltimore—The Autogenous Welding and Machine Co., 1213-1223 Maryland Ave.—machine tools.

Md., Baltimore — The Baltimore Drydocks and Shipbuilding Co., Wheeler Glenn, Pur. Agt.—machine tools.

Md., Baltimore—H. E. Crook & Co., Inc., 28 Light St.—72 in. lathe with 12 ft. bed, motor driven; 1,500 lb. steam drop hammer.

Md., Baltimore—The Maryland Motors Corp., 631 Munsey Bldg., Capt. T. B. Webster, Genl. Mgr.—equipment for the manufacture of motor trucks.

N. J., Newark—The Vreeland Motor Co., 407 Elizabeth Ave.—machine shop equipment.

N. Y., Buffalo—The W. A. Case & Son Mfg. Co., 31 Main St.—No. 1 or No. 2 full Universal cutter grinder, a surface grinder with 8 in. wheel and a 30 in. bed, and a full Universal tool room shaper, 18 to 24 in. (used).

N. Y., New York (Borough of Brooklyn)—The Doehler Die Casting Co., Court and 9th Sts.—bench and tool room lathe and a 16 in. shaper.

N. Y., New York (Borough of Manhattan)—Martin Gasser & Co., 61 Greenwich St.—lathes, boring mills, grinders, bench and shop tools.

N. Y., New York (Borough of Manhattan)—The Otis Elevator Co., 11th Ave. and 26th St.—radial drill, Universal drill press, sensitive drills, millers, turret lathes, automatic screw machines and a vertical boring mill.

N. Y., New York (Borough of Manhattan)—The Quartullo Welding and Machine Co., 110 West End Ave.—Norton & Landis crank shaft grinder.

N. Y., New York (Borough of Manhattan)—A. G. Schoonmaker & Son, 25 Church St.—18 in. Gleason gear generator to rough and finish gears (new or used).

N. Y., New York (Borough of Manhattan)—The Utah Copper Co., 25 Broad St.—general machine tools.

N. Y., New York (Borough of Manhattan)—The White Oil Corp., 501 5th Ave.—pipe working equipment machine and hand tools.

N. Y., New York (Borough of Queens)—The Packard Service Station, Long Island City—tool room lathes and a No. 2 miller.

N. Y., Niagara Falls—The United States Light and Heat Co., 3215 Highland Ave.—No. 10 and 11 B. & S. external grinders, equipped for motor drive.

N. Y., Syracuse — The Crouse Hinds Co., Wolf and 7th Sts.—two 16 in. Hendy lathes.

N. Y., Syracuse—The Dyneto Electric Corp., Wolf St., L. L. Kuntz, Pur. Agt.—one 2 spindle chuck for drill press 1¼ in. center for No. 2 Morse taper shank drill press.

Pa., Koppel—The Koppel Industrial Car Equipment Co.—screw cutting double back gear lathe, 28 in. swing, 8 ft. between centers (new or used).

Pa., Philadelphia—The Baldwin Locomotive Wks., Broad and Spring Garden—light machine tools and drills, reamers and taps.

Pa., Philadelphia—W. J. Starr, 2128 Alder St.—14 in. turret lathe (used).

Pa., Philadelphia — M. Tarafchi, 1934 South Lambert St.—lathe, 11 in. swing 6 ft. bed (used).

Pa., Scranton—The Lackawanna Builders' Supply Co., 411-13 Real Estate Exchange Bldg.—woodworking machinery.

Pa., Waynesboro—The Victor Tool Co.—lathes, shapers, grinders and machine shop equipment.

Ill., Chicago—The Steel and Tube Co. of America, 111 West Washington St.—48 in. x 20 ft. heavy duty lathe with taper attachment and 4 jaw chuck, arranged for direct motor drive.

Ill., Peoria—The Holt Mfg. Co., Washington St.—2 Rockford horizontal drilling, boring, and tapping machines, with reversible countershaft (new or used)., and Niagara power squaring shears, 12 h.p., to cut and square plates to $\frac{5}{16}$ in.

Ill., Pullman—The Pullman Co., 79 East Adams St.—large burring machine similar to a No. 577 Peck, Stow & Wilcox, and a bar folder similar to a No. 62 Peck, Stow & Wilcox (new).

Ind., Gary—The Leonard Tractor Co., 201 Reynolds Bldg.—lathes, milling machines, grinder, shaper, drill presses, sensitive drill press and small tool room equipment.

Ind., South Bend—The South Bend Lathe Wks.—34 in. x 14 ft. Ingersol planer type milling machine with 3 vertical heads.

Mich., Ann Arbor—The Economy Baler Co., North Main St.—one ¼ in. circle and slitting shears, one 42 in. vertical boring mill with 1 turret and 1 swivel head and one No. 2 or No. 2½ Universal milling machine (new or used).

Mich., Battle Creek—The Clark Equipment Co., Buchanan—machine shop equipment for machining and assembling motor axles.

Mich., Detroit—The Voltmeter Co., 66 East Fort St.—1 South Bend lathe, 10 ft. bed (used).

Mich. Flint—The Marshall Automobile Co., 125 East 3rd St.—repair shop equipment.

Mich., Greenville—The Moore Plow and Implement Co.—Grey iron foundry and pattern shop equipment.

Mich., Lansing—The Federal Forge Co.—power hammer.

Mich., Ludington—The Monroe Body Co., c/o R. F. Monroe—equipment for the manufacture of automobile bodies.

Mich., St. Clair—Gracey & Slocum, 2nd St.—miscellaneous machine shop equipment.

O., Canton — The Hercules Motor Co., Halliwell Pl.—four No. 4 milling machines, 2 vertical, 2 horizontal.

O., Cleveland—The Biggs Watterson Co., 1235 West 9th St.—3 Rockford horizontal boring mills or similar, (new or used). 20 in. Superior drill presses and Nos. 54, 57 or 58 Toledo presses.

O., Columbus—The Lewellen Mfg. Co.—drill with tap attachment, lathe for shaft straightening, 16 to 24 in. swing, not less than 10 in. between centers, punch for holes through ⅞ in. iron, which will cut off bars ⅞ to 4 in.

O., Coshocton—The Keagy & Lain Machine Co.—bolt cutter (used) and a No. 3 Metz keyseater, power hack saw, spur gear cutter, to take up to 30 in. (new).

O., Springfield—The Foos Gas Engine Co., Monroe and Linden Sts.—gear cutting machine, a 2 in. screw cutting machine and an 18 or 20 in. turret lathe.

Wis., Barton—The Woodford Eng. Co.—machine tools.

Wis., Janesville—The Samson Tractor Co., a sub-division of the Genl. Motors Corp., 88 East Congress St., Detroit, Mich.—a 500 lb. drop hammer (used).

Wis., Milwaukee — H. C. Boorse, 155 Oneida St.—1 lathe and 2 or 3 drill presses.

Wis., Milwaukee—M. Kuehn, 1650 Green Bay Ave.—lathe for garage repair work.

Wis., Milwaukee—The Mechanical Equipment Co., 129 Michigan St.—lathes, automatic screw machine and a radial drill.

Wis., Milwaukee—The Pressed Steel Tank Co., Greenfield Ave.—drill with 44 in. swing, spindle must be not less than 4 in. in diameter (new or used).

Wis., Nekoosa—The Nekoosa Motor and Machine Co.—garage repair machinery.

Wis., Sheboygan—The Sheboygan Foundry Co., c/o L. Nelson—machine tools.

Col., Pueblo—The Pueblo Machine Wks., 407 West 4th St.—two 16 to 18 in. x 8 to 10 ft. lathes.

Okla., Cement—The Excel Tool Co., Garber—lathes, drill presses, pipe cutting and threading machines, etc.

Ont., Hawkesbury—Hopkins & Plaunt, Renfrew—milling machinery, grinders, rollers, conveyors and elevating machinery.

Ont., Ottawa — A. F. Macallum, City Engr.—1 miller and a drill press.

Ont., Sarnia—S. L. McKay—two No. 76½ Bliss straight side forging presses and a No. 7 double action forging press.

Machinery

Conn., Norwalk—H. Jacobs & Sons, Belden Ave.—machinery for the manufacture of shoes and leggins.

Mass., Brockton—G. E. Keith & Co., 23 Station Rd.—machinery for the manufacture of shoes.

Mass., Fall River—The Sanford Spinning Co., Globe Mills Ave.—twisting machinery and machine tools.

Mass., Fitchburg—The Fitchburg Paper Co., 804 Main St.—machinery for the manufacture of paper.

N. H., Belleville — The Sweeney Lithograph Co., 251 West 19th St., New York City—lithographing machinery.

Md., Baltimore—The Hess Steel Corp., Biddle St. and Loney's Lane—shear, 2 in. square capacity, open side or guillotine.

N. J., Edgewater—The Aluminum Co.—Engine lathes, milling machines and shapers.

N. Y., Syracuse—The Durston Gear Co., Maltbie St.—sand blast machine.

Pa., Erie—The Fries Stove and Mfg. Co., —No. 3 Crescent Universal Band saw table (used).

Pa., Kingston (Wilkes-Barre P. O.)—The Crane Bros. Inc.—silk throwing machines.

Pa., Philadelphia—The Precision Grinding Wheel Co., Heed Bldg. — hydraulic presses.

Pa., Philadelphia—The Cambria Steel Co., Widner Bldg.—Lathes.

Ill., Chicago—H. W. Angstein, 1301 Westminster Bldg.—serpentine plate shear.

Il., Chicago—Swift & Co., U. S. Yards—saw bench with center shaft and pulleys, similar to J. A. Fay & Egan, No. 1.

Ill., Joliet—The G. M. Ditto Mfg. Co.—automatic wire straightening and cutting machine to handle ¼ in. wire, 29 in. long (new or used).

Mich., Detroit—The Monroe Sheet Metal Wks., 500 Myrtle Ave.—10 in. bending brake.

Mich., Detroit—The Peninsular Paper Can Co., Catherine and Hastings Sts.—One 30 or 36 in. foot power squaring shears.

Mich., Holland—The Holland Shoe Co.—machinery for the manufacture of shoes.

Mich., Monroe—The Monroe Paper Products Co., West Elm St.—machinery for the manufacture of corrugated paper boxes.

O., Cleveland — Bd. Educ. — lathe, saws and woodturning machinery.

O., Cleveland—The A. B. Shepard Co., 1836 Euclid Ave.—power shears, alligator type, for cutting ¾ in. plate (new or used).

Wis., Appleton—The Hayton Pump and Blower Co., 575 2nd Ave.—traveling crane.

Wis., Belguim — The Witmeyer-Hubing Shoe Co.—machinery for the manufacture of shoes.

Wis., Grand Rapids — The MacKinnon Mfg. Co., 717 Grand Ave.—machinery for making wooden wagon spokes.

Wis., Marinette—The H. F. Below Lumber Co.—planing mill machinery.

Ia., Cedar Rapids—Penick & Ford—sheet metal and woodworking machinery.

Mo., St. Louis — The Liberty Systems Corp., 2310 Locust St.—cold rolled flat stock 40/1000, 50/1000, 65/1000, 95/1000, 32/1000 thick, up to 2,000 lb. each.

Ont., Clinton—J. J. Merner, Seaforth—machinery for extracting oil and rolling and grinding flax.

Ont., Saulte Ste. Marie—The Natl. Electro Products Ltd., 83 Church St., Toronto—machinery and equipment for the manufacture of liquid oxygen.

Metal Working

NEW ENGLAND STATES

Mass., Boston—The G. T. McLauthlin & Co., 120 Fulton St., will build a 5 story, 39 x 100 ft. factory, on North St., for the manufacture of machinery for elevators. Estimated cost, $50,000.

Mass., East Springfield—The Storms Drop Forging Co., 168 Bridge St., will soon award the contract for the construction of a 1 story forge plant, on Robert's Rd. Estimated cost, $25,000.

Mass., East Springfield—The Westinghouse Electric Co., 6905 Susquehanna St., Pittsburgh, Pa., will build a 1 story, 100 x 1,000 ft. machine shop. Estimated cost, $360,000.

Mass., Marlboro — Lapham & Powning plans to build a 2 story, 60 x 300 ft. factory, for the manufacture of miner's safety lamps. Estimated cost, $100,000.

Mass., Norfolk Downs (Boston P. O.)—The Vedoe Peterson Co., 167 Olive St., Boston, machinists, has awarded the contract for the construction of a 1 story, 50 x 120 ft. machine shop, here. Estimated cost, $25,000.

Mass., Roxbury (Boston P. O.)—The Trimont Mfg. Co., 55 Amory St., will soon award the contract for the construction of a 3 story, 40 x 240 ft. factory, for the manufacture of tools. Estimated cost, $100,000.

Mass., Westfield—F. Schmidt, 24 School St., plans to build a 1 story garage, on Church St. Estimated cost, $30,000.

Mass., Worcester—The Norton Co., Barbers Crossing, plans to build a 6 story, 75 x 150 ft. factory, for the manufacture of grinding machinery, at Greendale. Estimated cost, $250,000.

R. I., Pawtucket—L. B. Fogarty, 348 Central Ave., has awarded the contract for the construction of a 2 story, 70 x 110 ft. garage, on Broadway. Estimated cost, $30,000.

MIDDLE ATLANTIC STATES

N. J., Trenton—The H. D. Lee Mercantile Co., 13 East State St., will soon award the contract for the construction of a 6 story, 67 x 155 ft. factory. Estimated cost, $300,000. W. Hankin, 241 South Warren St., Archt.

N. Y., Buffalo—The Genl. Drop Forge Co., 1738 Elmwood Ave., is having plans prepared by E. McGeorge, Archt., 1900 Euclid Ave., Cleveland, Ohio, for the construction of a 1 story, 60 x 100 ft. forge shop. Estimated cost, $75,000.

N. Y., New York (Borough of Brooklyn)—L. Bernstein, c/o S. Millman, Archt., 26 Court St., will build a 1 story, 150 x 250 ft. garage, on Myrtle Ave. between Bury and Lewis Aves. Estimated cost, $75,000.

N. Y., New York (Borough of Brooklyn)—A. Margolin, c/o S. Millman, Archt., 26 Court St., will build a 1 story, 100 x 150 ft. garage, on 63rd St. Estimated cost, $40,000, and a 1 story, 100 x 100 ft. garage, on 10th Ave. and 19th St. Estimated cost, $25,000.

N. Y., Schenectady—The Genl. Electric Co., River Rd., plans to build a 1 story, 206 x 600 ft. punch press shop. Estimated cost, $700,000.

N. Y., Watertown—Bagley & Sewall Co., manufacturer of paper making machinery, has awarded the contract for the construction of a 1 story, 100 x 235 ft. machine shop, on East Moulton St. Estimated cost, between $75,000 and $100,000. S. D. Lansing, Pres.

Pa., Erie—The Hays Mfg. Co., 12th and Liberty Sts., will soon award the contract for the construction of a 3 story, 57 x 115 ft. factory, for the manufacture of plumbers supplies. Estimated cost, $150,000. Noted Feb. 12.

Pa., Scranton—The Maccar Truck Co. plans to build a 2 story, 100 x 660 ft. factory, on Providence Rd.

Pa., Steelton—C. P. Turner, Ch. Engr. of the Bethlehem Steel Co. will soon award the contract for the construction of a 2 story, 50 x 100 ft. laboratory. Estimated cost, $50,000. Bissel & Sinkler, Otis Bldg., Philadelphia, Archts.

SOUTHERN STATES

Tenn., Knoxville—C. Rodgers plans to build a 2 story, 80 x 95 ft. garage and a 30 x 75 ft. repair shop, on West Main St. Estimated cost, $50,000.

MIDDLE WEST

Mich., Battle Creek—The Clark Equipment Co., Buchanan, is having plans prepared for the construction of a 1 story, 100 x 450 ft. and 50 x 450 ft. factory, a detached power plant and 2 story office building, along the tracks of the Michigan Central R.R. Billingham & Cobb, 403 Telegraph Press Bldg., Kalamazoo, Archts. and Engrs.

Mich., Detroit—Bd. Educ., 50 Broadway Ave., will soon award the contract for the construction of a 7 story, 250 x 350 ft. technical school, on 2nd Ave., to include a manual training department. Estimated cost, $2,500,000. Malcolmson, Higginbotham & Palmer, 405 Moffat Bldg., Archts.

Mich., Flint—The Marshall Automobile Co., 125 East 3rd St., will soon award the contract for the construction of a 2 story, 50 x 183 ft. garage. G. H. Swift, 105 Armory Block, Archt.

Mich., Hamtramck (Detroit P. O.)—The Dodge Bros., 1678 Joseph Campau Ave., plans to build an 8 story, 77 x 266 ft. factory for the manufacture of automobile bodies, on Conant Ave. Smith, Hinchman & Grylls, 710 Washington Arcade, Detroit, Engr.

O., Cleveland—The Akron Spark Plug Co., Akron, will soon award the contract for the construction of a 1 story, 60 x 125 ft. addition to its factory, on Woodland Ave., here. Estimated cost, $30,000. A. F. Janowitz, Permanent Bldg., Archt.

O., Cleveland—Bd. Educ. is having plans prepared by W. R. McCormack, Archt., East 6th St. and Rockwell Ave., for the construction of a 1 story school, to include a manual training department, on Parkgate Ave. Estimated cost, $500,000.

O., Cleveland—The Cataract Motor Sales Co., 8818 Broadway, plans to build a 3 story, 80 x 250 ft. garage and automobile sales station. Estimated cost, $100,000. A. J. Schustrich, Pres.

O., Cleveland—The Demco Machine Tool Co., 706 Frankfort Ave., plans to build a 1 story factory. Estimated cost, $75,000. C. H. Loew, Secy.

O., Cleveland—The Euclid Foundry Co., c/o Hulett & Stanton, Archts., 226 Superior Ave., is having plans prepared for the construction of a 1 story, 125 x 140 ft. foundry, on St. Clair Ave., along the tracks of the New York Central R.R. Estimated cost, $75,000.

O., Greenville — The Jeffreys Co. has awarded the contract for the construction of a 2 story, 60 x 180 ft. factory, for the manufacture of machinery. Estimated cost, $50,000.

Wis., Barton—The Woodford Eng. Co. is having plans prepared by The Condron Co., Engrs. and Archts., 53 West Jackson St., Chicago, Ill., for the construction of a 2 story, 45 x 120 ft. machine shop, on Main St. Estimated cost, $52,000.

Wis., Sheboygan—The Jenkins Machine Co., 315 North 8th Ave., is having plans prepared by Juul & Smith, Archts., Imig Bldg., for the construction of a 1 and 2 story, 150 x 200 ft. machine shop and office building. Estimated cost, $50,000.

Wis., Sheboygan—The Sheboygan Foundry Co. c/o L. Nelson, has awarded the contract for the construction of a 1 story, 50 x 180 ft. foundry, on South 18th St. and Union Ave. Estimated cost, $70,000.

WEST OF THE MISSISSIPPI

Ia., Blackfoot—The Bills Automobile Co. has awarded the contract for the construction of a 2 story, 75 x 125 ft. garage. Estimated cost, $70,000.

Kan., Wichita—The Watkins Mfg. Co. plans to build a 2 story factory, on 1st and Water Sts., for the manufacture of all steel grain grading machines. Estimated cost, $50,000.

Neb., Aurora—The Sandin Automobile Co. will soon award the contract for the construction of a 2 story, 120 x 211 ft. garage. Estimated cost, $60,000. Grabe & Helleberg, Columbus, Archts.

Okla., Cement—The Excel Tool Co., Garber, plans to build a 1 story tool shop and factory here. Estimated cost, $50,000. D. B. Thomas, Gen. Mgr.

WESTERN STATES

Cal., Los Angeles—W. I. & T. P. Tupman, 3548 South Vermont Ave., has awarded the contract for the construction of a 1 story, 120 x 200 ft. garage, on Feguerоa and Jefferson Sts. Estimated cost, $60,000.

Ore., Astoria—S. Lovell and Staples has awarded the contract for the construction of a 2 story, 100 x 125 ft. garage, on Duane St. Estimated cost, $70,000.

Wash., Colfax—H. I. Willis and J. H. Mohney will build a 1 story, 130 x 150 ft. garage, on Mill St. Estimated cost, $50,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Meriden—The Miller Bros. Cutlery Co., 464 Pratt St., will soon award the contract for the construction of a 4 story, 50 x 90 ft. factory. Estimated cost, $50,000. W. T. Arnold, 105 Elm St., Archt.

Conn., Middletown—The Wesleyan University, 374 High St., is having plans prepared by H. Bacon, Engr., 101 Park Ave., New York City, for the construction of a 2 story chemical laboratory. Estimated cost, $500,000.

Conn., Norwalk—H. Jacobs & Sons, Belden Ave., will build a factory, on Day St., for the manufacture of shoes. Estimated cost, $35,000.

Conn., Stamford—The Carlisle Tire Corp., 251 4th Ave., New York City, has awarded the contract for the construction of a 1 story factory on Fairfield Ave. Estimated cost, $250,000.

Conn., Westbrook — The Knothe Bros. Co., 124 5th Ave., New York City, has awarded the contract for the construction of a 2 story, 54 x 150 ft. factory, for the manufacture of suspenders. Estimated cost, $120,000.

Me., Portland—T. A. Huston & Co., 26 Main St., Auburn, has awarded the contract for the construction of a 7 story, 110 x 120 ft. bakery, on Forest Ave. Estimated cost, $375,000.

Me., Rockland—The Rockland and Rockport Lime Corp. plans to rebuild its plant, which was recently destroyed by fire.

Mass., Brockton—The Puritan Shoe Mfg. Co., 263 North Main St., plans to build a 5 story, 70 x 200 ft. factory, on North Main St., for the manufacture of shoes. Estimated cost, $175,000. Tuck & Gilman, 34 School St., Boston, Archts. and Engrs.

Mass., Cambridge—The Lever Bros. Co., Portland St., manufacturer of soap, is having plans prepared by C. T. Main, Engr. and Archt., 201 Devonshire St., Boston, for the construction of a 6 story factory.

Mass., Fitchburg—Crocker-Burbank Co., 545 Westminster St., manufacturer of paper, has awarded the contract for the construction of a 1 story factory, on the site of its present plant. Estimated cost, $300,000.

Mass., Lee—The Smith Paper Co., has awarded the contract for the construction of two, 2 story, 50 x 140 ft. factories. Total estimated cost, $120,000.

Mass., Lynn—T. Kelly & Co., 629 Summer St., manufacturer of morocco, has awarded the contract for the construction of a 1 story, 40 x 175 ft. addition to its factory, on Linden St. Estimated cost, $35,000.

Mass., Malden—C. H. Moss, 48 Grace St., has awarded the contract for the construction of a 1 story, 50 x 100 ft. factory, for the manufacture of preserves, on Pearl St. Estimated cost, $25,000.

Mass., North Adams—The H. W. Clark Biscuit Co., 185 Ashland St., will soon award the contract for the construction of a 4 story, 90 x 140 ft. bakery. Estimated cost, $150,000. W. Higginson, 13 Park Row, New York City, Engr.

Mass., Roxbury (Boston P. O.) — The Drake Bros. Co., 85 Savin St., has awarded the contract for the construction of a 3 story, 50 x 104 ft. addition to its bakery, on Quincy St. Estimated cost, $50,000.

Mass., Springfield — The Country Club Soda Co., Emery St., has awarded the contract for the construction of a 4 story, 50 x 104 ft. factory. Estimated cost, $45,000.

Mass., Springfield—The Diamond Match Co., 98 Friend St., Boston, plans to build a factory. Esimated cost, $500,000.

N. H., Somersworth—The Great Falls Mfg. Co., Main St., has awarded the contract for the construction of a 4 story, 140 x 600 ft. factory, for the manufacture of cotton goods. Estimated cost, $1,500,000. Noted Mar. 11.

R. I., Pawtucket—The Amer. Lace Wks., Main St., has awarded the contract for the construction of a 1 story, 50 x 150 ft. addition to its mill. Estimated cost, $25,000.

R. I., Providence—The Joslin Mfg. Co., 610 Manton Ave., has awarded the contract for the construction of a 3 story, 60 x 140 ft. factory, for the manufacture of shoe lacings, on Tobey St. Estimated cost, $70,000.

MIDDLE ATLANTIC STATES

N. J., Belleville—The Sweeney Lithograph Co., 251 West 19th St., New York City, has awarded the contract for the construction of a 2 story, 80 x 150 ft. factory, on Courtland St., here. Estimated cost, $60,000.

N. J., Jersey City—The Whitlock Cordage Co., Communipaw Ave., has awarded the contract for the construction of a 4 story factory. Estimated cost, $400,000.

N. J., Newark—G. J. Downes & Co., 344 Mulberry St., has awarded the contract for the construction of a 3 story, 65 x 90 ft. factory, for the manufacture of optical goods, on Elizabeth Ave. and Punjon St. Estimated cost, $60,000.

N. Y., Buffalo—The Genl. Drop Forge Co., 1738 Elmwood Ave., is having plans prepared by E. McGeorge, Engr. and Archt., 1900 Euclid Ave., Cleveland, Ohio, for the construction of a 1 story, 100 x 100 ft. heat treating plant. Estimated cost, $75,000.

N. Y., New York (Borough of Brooklyn) —H. R. Planten, 93 Henry St., has awarded the contract for the construction of a 5 story factory, for the manufacture of capsules. Estimated cost, $25,000.

N. Y., Salamanca—The Kendall Refining Co., Kendall Ave., Bradford, Pa., plans to build a 2 story, 30 x 40 ft. office and storage building, on Broad St., here. Estimated cost, between $50,000 and $60,000.

MIDDLE WEST

Mich., Grand Rapids — W. H. Spears, manufacturer of shoes, c/o P. Lindout, Archt., 817 Lake Drive, will soon award the contract for the construction of a 3 story, 50 x 100 ft. factory. Estimated cost, $80,000.

O., Cleveland—The Natl. Builders Co., 1787 West 11th St., has awarded the contract for the construction of a 1 and 2 story factory, for the manufacture of building materials, on Park Ave. Estimated cost, $75,000.

O., New Philadelphia—The Weiss McClung Co. plans to build a 1 and 3 story factory. Estimated cost, $300,000. W. F. Ferguson Co., 1900 Euclid Ave., Cleveland, Archt.

O., Willoughby—The Thor Tire and Rubber Co., 802 Society for Savings Bldg., Cleveland, is having plans prepared by H. H. White, Engr. and Archt., 802 Society for Savings Bldg., Cleveland, for the construction of a 1 and 2 story factory, on Main St., along the tracks of the New York Central R.R. Estimated cost, $100,000.

Wis., Belgium — The Witmeyer-Hubing Shoe Co. is having plans prepared by H. J. Esser, Archt., Camp Bldg., Milwaukee, for the construction of a 3 story, 55 x 120 ft. factory on Main St. Estimated cost, $40,000.

Wis., Carrollville—The U. S. Glue Co. plans to build a 3 story, 375 x 500 ft. factory. Estimated cost, $500,000. H. J. Esser, Camp Bldg., Milwaukee, Engr. and Archt.

Wis., Saukville—The Saukville Canning Co. will build a 2 story, 36 x 376 ft. pea canning factory, on Main St. Estimated cost, $40,000. W. F. Hilgerr, Cedarburg, Archt.

WEST OF THE MISSISSIPPI

Ia., Marshalltown—The Neilson Butter and Ice Cream Co. is having plans prepared by H. E. Reimer, Archt., Marshalltown, for the construction of a 2 story, 50 x 58 ft. factory. Estimated cost, $65,000.

Kan., Coffeyville—The Kansas Oil Refining Co. plans to build an addition to its refinery, 2 miles south of here. Estimated cost, $500,000.

Minn., Duluth—The Northwest Products Co., c/o Marshall Wills Co., Lake Ave., has awarded the contract for the construction of a 1 story, 44 x 60 ft. factory, for the manufacture of paint. Estimated cost, $15,000.

Okla., Kingfisher—The Oklahoma Mill Co. plans to build a 7 story, 36 x 100 ft. flour mill. Estimated cost, $200,000.

Tex., Orange—The Mogul Oil and Refining Co. plans to build an oil refinery, to have 10,000 barrel capacity. Estimated cost, $1,000,000.

WESTERN STATES

Cal., Sacramento—The Sacramento Meat Canning and Packing Co., plans to build a packing plant, on 10th St. near the Sacramento River. Estimated cost, $500,000.

Ore., Roseburg—The Oregon Growers' Association plans to build a 3 story prune packing plant, on site adjoining apple packing plant. Estimated cost, $50,000.

CANADA

Ont., Clinton—J. J. Merner, Seaforth, having plans prepared for a 3 story, 40 x 60 ft. flax mill., here.

Ont., Hawkesbury—Hopkins & Plaunt, Renfrew, will soon award the contract for the construction of a 3 story flour mill. Estimated cost, $50,000.

Ont., Sault Ste. Marie—The Natl. Electro Products [illegible], 83 Church St., Toronto, plans to build [illegible] story plant, here, for the manufacture of liquid oxygen. Estimated cost, $25,000.

Que., Montreal — The Natl. Breweries Ltd., 36 Chaboillez Sq., has awarded the contract for the construction of a 3 story, 30 x 100 ft. brewery. Estimated cost, $35,000.

Que., Three Rivers—The Natl. Shipbuilding Corp. has awarded the contract for the construction of a 95 x 340 ft. shipbuilding factory, on River Rd. Estimated cost, $100,000.

TURN NOW TO PAGES 332 TO 369

There you will find the latest opportunities being offered in this industry

Positions Vacant — **Positions Wanted**
Surplus Equipment For Sale — **Second-Hand Equipment For Sale**
Equipment Wanted — **Business Opportunities**

THE SEARCHLIGHT SECTION

is the "Opportunity" advertising of the machinery field for every business want

THINK "SEARCHLIGHT" FIRST